

Sexual violence, pregnancy and childbirth

Studies investigating the association of experienced sexual violence and outcomes in pregnancy and childbirth

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Summary

Background: Sexual violence against women is a recognised public health problem, and it is a phenomenon that persists in all countries regardless of value system and culture. There is growing evidence that women who have experienced sexual violence are at greater risk for negative health outcomes, even several years after the abuse. Pregnancy does not protect women from violence. For some women, pregnancy may be the first time that they are aware of previous exposure to violence, or trauma that they have experienced may resurface.

Objectives: The first aim of our study was to explore whether a history of sexual violence was associated with pregnancy-related physical symptoms. Second, we investigated the relationship between lifetime sexual violence and antenatal hospitalisations. Third, we assessed the association between sexual violence and mode of delivery, and finally, we examined the relationship between a history of sexual violence and neonatal outcomes.

Subjects and methods: In this thesis, we used data from the Norwegian Mother and Child Cohort study (MoBa) linked to data from the Norwegian Medical Birth Registry. Studies I and II had a cross-sectional design and included 78 660 pregnant women. Studies III and IV were cohort studies that included 74 058 and 76 870 pregnant women, respectively. The participating women were recruited during their routine ultrasound examination, and they completed extensive questionnaires at 17 and 30 weeks gestation. History of sexual violence was reported at three levels of severity: 1) pressured into sexual acts (mild), 2) forced with violence (moderate), and 3) raped (severe). The comparison group was women not reporting sexual violence.

Results: In our studies, 12.0% of the women reported mild sexual violence, 2.8% reported moderate sexual violence and 3.6% reported severe sexual violence (rape). Compared with women who did not report a history of sexual violence, women who reported a history of sexual violence suffered from more pregnancy-related physical symptoms and were more often hospitalised during pregnancy. Severe sexual violence was associated with a higher risk of elective caesarean section (CS), and moderate sexual violence was associated with an increased risk of emergency CS. There was no significant association between sexual violence and neonatal outcomes.

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Definitions and Abbreviations

AOR	Adjusted odds ratio
ASS	Abuse Assessment Screen
BMI	Body mass index
CI	Confidence interval
CS	Caesarean section
EU	European Nation
EDA	Epidural Analgesia
HPA	Hypothalamic-Pituitary-Adrenal
LBW	Low birth weight
IPV	Intimate partner violence
MBRN	Medical Birth Registry of Norway
MoBa	The Norwegian Mother and Child Cohort Study
OR	Odds ratio
PTB	Preterm birth
PTSD	Post-traumatic stress disorder
Q1	Questionnaire 1
Q3	Questionnaire 3
SCL-5	Hopkins Symptom Check List including 5 items
SGA	Small for gestational age
WHO	World Health Organization

List of papers

This thesis builds on the following papers:

Paper I

Lukasse M, Henriksen L, Vangen S, Schei B. Sexual violence and pregnancy-related physical symptoms. BMC Pregnancy Childbirth 2012 11;12:83

Paper II

Henriksen L, Vangen S, Schei B, Lukasse M. Sexual violence and antenatal hospitalizations. Birth 2013 40:281-8

Paper III

Henriksen L, Schei B, Vangen S, Lukasse M. Sexual violence and mode of delivery: a population-based cohort study BJOG 2014 121:1237-1244

Paper IV

Henriksen L, Schei B, Vangen S, Lukasse M. Sexual violence and neonatal outcomes: a Norwegian population-based cohort study. BMJ Open 2014;4:e005935 doi:10.1136/bmjopen-2014-005935

1. Introduction

Sexual violence against women is a significant and global public health problem.¹⁻⁴ A recent report from the World Health Organization (WHO) states that 35% of women worldwide have experienced physical and/or sexual violence.¹ It is recognised that sexual violence has an adverse impact on women's physical, psychological, behavioural and reproductive health,^{1,4-14} including pregnancy complications.¹⁵⁻¹⁷ Pregnancy does not protect women from violence,¹⁸ and the prevalence of physical or sexual violence during pregnancy ranges from 3-11% in high-income countries.¹⁹⁻²¹ Several pathways are suggested between sexual violence and adverse health for pregnant women,¹ and women with a history of sexual violence can experience immediate and long-term morbidity.^{22,23} A direct pathway of sexual violence can result in injury and immediate complications such as bleeding, rupture of membranes and preterm birth.^{1,24-26} More indirect and complex pathways include physiological, psychological, behavioural and socio-economic factors.^{1,24,26, 27}

Health-care providers need to understand the relationship between sexual violence and women's ill health to be able to respond appropriately when they treat women with a history of sexual violence.¹ When women attend maternity care or other reproductive health services, an opportunity to support and help those who have been exposed may be present. In Norway, almost every pregnant woman attends antenatal care, a free and well-integrated part of the public health system,²⁸ and care encounters during pregnancy may represent an opportune time for investigation of sexual violence. During antenatal appointments, it may also be possible to give information about adequate interventions for women living in violent relationships. Given the high prevalence of sexual violence, it is likely that a considerable proportion of pregnant women have been victims of sexual violence at some point during their lives. The majority of studies that have examined the association between a history of sexual violence and complications during pregnancy have primarily focused on childhood abuse or previous and current intimate partner violence, which can include physical and emotional abuse as well as sexual violence.^{17,29-36} This thesis originated from a desire to better understand the consequences of lifetime sexual violence on pregnancy and childbirth. Though the literature is inconclusive, some studies have shown strong associations between adverse outcomes and sexual violence, including a 9-fold increase in the odds ratio of caesarean section among women raped as adults³⁷ and a greater than 3-fold increase in the odds ratio of premature delivery among women with a history of sexual violence.³⁸ Nevertheless, the majority of studies have shown smaller or no effects.^{1,29,30,36, 39-42}

1.1 What is sexual violence?

To define sexual violence, it is necessary to first define violence. The WHO uses the following definition of violence:⁴³

*The intentional use of physical force or power, threatened or actual, against oneself, another person, or against a group or community, that either results in or has a high likelihood of resulting in injury, death, psychological harm, maldevelopment or deprivation (page 5.)*⁴³

This definition encompasses all types of violence and covers the wide range of acts that constitute violence, as well as outcomes beyond death and physical injuries.⁴³ Violence affects men, women and children and is recognised as a public health problem and a violation of human rights.⁴³

This thesis focuses on sexual violence, which is defined by the WHO as follows:

*“ Any sexual act, attempt to obtain a sexual act, unwanted sexual comments or advances, or acts to traffic, or otherwise directed against a person’s sexuality using coercion, by any person regardless of their relationship to the victim, in any setting including but not limited to home and work ” (page 149).*⁴³

Coercion can cover a range of acts such as psychological intimidation, blackmail or other threats of physical harm, and actual violence.⁴³ The definition also includes the inability to give consent due to intoxication, being drunk or being asleep.⁴³ Sexual violence includes rape, traditionally defined as vaginal, anal or oral sexual intercourse obtained through force or threat of force.⁴³⁻⁴⁵ Rape is usually defined as the most serious act of sexual violence.⁴³ Although both men and women are exposed to violence, women are more likely to be exposed to sexual violence, and perpetrators are usually men.⁴⁶⁻⁴⁸ An important issue regarding sexual violence is the relationship between the victim and the perpetrator, and research has shown that a substantial proportion of violence occurs within intimate partner relationships such as marriage or cohabitation.^{3,49} Sexual violence perpetrated by others, such as strangers, friends, teachers or colleagues, is usually referred to as non-partner sexual violence.² Intimate partner sexual violence and non-partner sexual violence are similar in terms of risk factors and health effects.⁵⁰ Nevertheless, there are some differences; sexual violence by an intimate partner may occur over a long time period, while rape by strangers may be a more violent single event.^{3,50,51}

1.2 Prevalence of sexual violence

The investigation of sexual violence is a challenge from both an ethical and a methodological perspective.^{1,52} Comparing studies is difficult, and prevalences vary due to both differences in settings and differences in the methods and measurements used.^{5,53} Sexual violence is stigmatising; it may carry social sanctions for women who report it, and under-reporting is considered common.^{1,48} This under-reporting makes it difficult to assess the actual prevalence. In addition, the focus has been on intimate partner violence, which typically includes several types of violence: physical, emotional and sexual.² The development of a common definition and measurement tools for non-partner sexual violence has not received the same

attention as IPV.² When examining the prevalence of violence, it is common to use instruments that measure several types of violence.⁵⁴ For example, the Abuse Assessment Screen (AAS) measures physical, sexual and emotional abuse.⁵⁵ Currently, stand-alone specialised surveys are considered the gold standard for obtaining valid data on sexual violence against women.¹ The 2000–2003 “WHO multi-country study on women’s health and domestic violence against women”, one example of this type of survey, examined physical and sexual violence by an intimate partner at fifteen sites in ten countries, and the lifetime prevalence of intimate partner sexual violence ranged from 6% in city sites in Japan to 59% in Ethiopian provinces.⁵⁶

A new worldwide prevalence of sexual violence against women can be found in the 2013 WHO report: “Global and regional estimates of violence against women: prevalence and health effects of intimate partner violence and non-partner sexual violence”.¹ This report states that 7.2% of women globally have reported non-partner sexual violence, and 30% have experienced physical and/or sexual violence by a partner.¹ In a Norwegian health survey that included all inhabitants in Oslo, 5.3% of the 8 643 participating women had been pressured into sexual acts as adults and 5% as children.⁵⁷ In another Norwegian study from 2008, Nerøien et al. found that 9.4% of the participating women had been exposed to sexual violence. This national study included 3 803 randomly selected women age 20–55 years.¹⁰ Table 1 presents studies that report different prevalences of sexual violence.

Table 1. Population-based studies of lifetime sexual violence

First author, publication year and country	Characteristics of the sample	Method	Sexual violence	Rape
Thoresen (2014) ⁵⁸ Norway	Population based, randomly sampled men and women N= 2 435 women	Telephone survey	25.4% ^a	9.4%
Nationellt centrum för kvinnofrid, NCK (2014) ⁵⁹ Sweden	Population based, randomly sampled men and women N= 5 681 women	Questionnaire based, paper and web	28% ^a	11% ^b
European union agency for fundamental rights, FRA (2014) ⁶⁰ All EU countries	Randomly sampled women from EU countries N=42 000	Face to face interviews	11%	5%
Abrahams (2014) ² Worldwide	Estimates from 77 studies	Systematic review	7.2% ^c 11.5 % ^d	NA
MacDowall (2013) ⁶¹ Britain	Population based survey, men and women	Computer-assisted personal interviews	19.4%	9.8%

	N=8869 women			
de Haas (2012) ⁶² Nederland	Population based survey, men and women N= 3 283 women	Online questionnaire	34%	12%
Steine (2012) ⁴⁷ Norway	Population based, randomly sampled men and women N=706 women	Questionnaire based	16.3% ^c	NA
de Vries (2009) ⁶³ Nederland	Population based, randomly sampled men and women N=1 087 women	Telephone survey	NA	5.4%
Nerøien (2008) ¹⁰ Norway	Population based, randomly sampled N=2 407 women	Questionnaire based	9.4% ^f	NA
Kilpatrick (2007) ⁶⁴ United States	A nationally representative sample N=3 001 women	Computer-assisted telephone Interviewing	NA	18%
Garcia-Moreno (2006) ⁵⁶ WHO, Multi country	Randomly sampled women from 10 countries ^g N=24 097	Face to face interviews	6 %-59%	NA
Balvig (2006) ⁶⁵ Denmark	Population based, women N= 3 552	Telephone survey	NA	9% ^h
Pape (2004) ⁶⁶ Norway	Randomly sampled men and women from Oslo N=2 355 women	Questionnaire based	16%	5%
Tjalden (1998) ⁶⁷ United States	Population based, men and women N=8000 women	Telephone survey	NA	18% ^h

^a Includes less severe violence

^b Includes severe sexual violence: forced intercourse or similar

^c Worldwide prevalence non-partner sexual violence

^d Western European prevalence of non-partner sexual violence

^e Unwanted sexual intercourse after age 16

^f Sexual violence in relationship

^g Sexual IPV in fifteen sites in ten countries: Bangladesh, Brazil, Ethiopia, Japan, Namibia, Peru, Samoa, Serbia and Montenegro, Thailand, and the United Republic of Tanzania

^h Completed or attempted rape

NA: Not Available

The reported prevalence of rape also varies, and studies report prevalences ranging from 3% to 20%.^{5,58,59,64,68} An official Norwegian report from 2008 estimated that 8 000 to 16 000 women are exposed to rape or attempted rape in Norway every year.⁶⁹ This inexact estimate, which was based on different prevalence studies at the time, reflects the difficulties and challenges inherent in measuring rape prevalence. The report stated that these estimates were conservative and that the majority of women exposed to rape or attempted rape do not report the abuse.⁶⁹ This finding is supported by a 2014 Norwegian telephone survey that examined safety, violence and life quality in Norway.⁵⁸ In that study, one-third of the women reported that they had never told anyone about the abuse.⁵⁸ A national telephone survey from the US that examined women's experiences with trauma and mental health reported similar results.⁷⁰ The prevalence of rape found in the recent Norwegian study was 9.4% among the women who participated.⁵⁸ Table 1 shows how the rape prevalence varies in different studies.

Studies examining the prevalence of lifetime sexual violence in pregnant populations report prevalences that range from 7% to greater than 30%.^{15,71-76} In one Swedish study that examined sexual violence among women who attended antenatal care, 8.4% of the respondents were exposed to lifetime sexual violence.⁷¹ In a cohort study from Denmark that included 2 638 low-risk nulliparous women, 9.2% had experienced lifetime sexual violence.⁷³ In a recent study that examined the prevalence of emotional, physical and sexual abuse among pregnant women in six European countries (Belgium, Iceland, Denmark, Estonia, Norway and Sweden), the prevalence varied from 8.3% to 21.1% for sexual abuse, with Iceland reporting the highest prevalence (21.1%) and Belgium reporting the lowest (8.3%).⁷⁵ The prevalence in Norway was 17.7%.⁷⁵ Two studies reporting prevalences greater than 30% are from the US, and both examined child sexual abuse only.^{15,76} Table 2 shows the prevalences of lifetime sexual violence and sexual violence during pregnancy measured in pregnant populations.

Table 2. Prevalence of lifetime sexual violence in pregnant populations and sexual violence during pregnancy (studies on childhood abuse only are not included)

First author, publication year and country	Characteristics of the sample	Study design	Sexual violence	Sexual violence during pregnancy
Van Parys (2014) ⁷⁷ Belgium	11 antenatal clinics N=1894	Cross-sectional	NA	1.4% ^a
Finnbogadóttir (2014) ⁷⁸ Sweden	Recruited at first antenatal visit N=1939	Cross-sectional	15.7%	0.7%
Lukasse (2014) ⁷⁵ 6 European countries ^b	Unselected pregnant women N= 7174	Prospective cohort	8.3-21.1%	0.4%
Groves	Recruited at first	Longitudinal	NA	3.2%

(2014) ⁷⁹ South Africa	antenatal visit N=445	study		
Salazar (2012) ⁸⁰ Nicaragua	All pregnant women in one municipal invited N=478	Prospective cohort	14%	7%
Schroll (2011) ⁷³ Denmark	Recruitment at antenatal clinics N= 2 638	Multi-centre cohort study	9.2%	NA
Nunes (2011) ⁴¹ Brazil	Women attending antenatal care N=652	Prospective cohort	7.4%	0.5%
Silva (2011) ⁸¹ Brazil	Pregnant women within Family Health Program N=960	Prospective cohort	5.7%	5.6%
Díaz- Olavarrieta (2007) ⁸² Mexico	Women attending antenatal care N=1314	Prospective cohort	10.1% ^c 3.7% ^d	1.8%
Van der Hulst (2006) ⁷² Nedertand	Low risk pregnant women N=625	Prospective cohort	11.2%	NA
Kaye (2006) ³² Uganda	Women recruited in pregnancy at hospital N=612	Prospective cohort	NA	2.7%
Faramarzi (2005) ³⁸ Iran	Women at postpartum units N=3 275	Cross- sectional	NA	19.2%
Neggers (2004) ⁴² US	Low-risk pregnant women N=3 103	Prospective cohort	NA	2.4%
Johnson (2003) ⁷⁴ UK	Pregnant women at antenatal booking N=475	Cross- sectional	10%	NA
Stenson (2003) ⁷¹ Sweden	Low risk pregnant women N=1 038	Cohort	8.1%	NA
Curry (1998) ⁸³ US	Abuse screening during pregnancy N=1 897	Prospective cohort	NA	4.5%

^a Sexual violence 12 months before pregnancy and/or in pregnancy

^b Belgium, Iceland, Denmark, Estonia, Norway and Sweden

^c Childhood

^d Last 12 month

NA: Not Available

1.3 Risk factors

Known risk factors for sexual violence are young age, drug and alcohol consumption, having many sexual partners and having a former history of abuse.^{43,84} Violence in families often transmits across generations, and compared with non-exposed children, children who witness or experience violence are more likely to experience or to perpetrate violence as adults.^{54,85} Low socioeconomic status is considered a risk factor for abuse⁸⁶ as is single marital status.⁸⁵ In addition, societal gender power inequalities and hierarchical gender relations increase sexual violence, both violence that occurs within families, marriage and dating relationships and non-partner sexual violence.^{4,87}

1.4 Sexual violence and health

Both physical and psychological health is affected by sexual violence.¹ Studies have shown that sexual violence is associated with the following: post-traumatic stress disorder (PTSD); anxiety disorders; depression; eating disorders; sleep disorders; chronic pain such as headaches, abdominal pain, fibromyalgia and pelvic pain; gastro-intestinal symptoms and sexually transmitted diseases.^{8,14,88-95} Women with a history of sexual violence often seek help from health-care providers for various somatic symptoms, and they do not necessarily connect their problems to the history of violence.^{91,96-98} It has been shown that risk-taking behaviour and self-destructive behaviour such as smoking and substance abuse are associated with the experience of sexual violence,^{26,99} and women that have experienced sexual violence are more likely than women without a history of abuse to report poor quality of health.^{9,61,88,100}

1.5 Sexual violence and pregnancy-related health

The general adverse health outcomes associated with sexual violence may also affect women in pregnancy. Pre-pregnancy health and negative health behaviours are likely to persist during pregnancy and affect health and health perception.⁷¹ For some women, pregnancy may be the first time they are aware of previous exposure to violence, or trauma they have experienced may resurface.^{101,102} The association between sexual violence and pregnancy-related health has been examined in terms of both maternal and neonatal outcomes.^{1,27,36,37,71,72,103,104} The majority of studies have examined the effect of IPV^{1,16,105,106} or child sexual abuse.^{15,29,34,35} Studies indicate that a history of sexual violence is associated with more common complaints due to physical changes in pregnancy, vaginal bleeding, hyper-emesis, urinary tract infections and premature contractions.^{17,34,68} Associations are also found between sexual violence and mode of delivery,^{35,76,103,107-109} induction,¹⁰³ use of pain relief,¹⁰³ episiotomies^{35,72} and anal sphincter tears.³⁵ In addition, studies have shown an association between sexual violence and preterm birth and low birth weight.^{1,29,38,110} Nevertheless, the findings are inconclusive, and several studies have not found an association between sexual violence and complications during pregnancy and childbirth.^{15,30,32,40,71,72,104} Most evidence regarding the association

between sexual violence and health for pregnant women comes from cross-sectional studies, which are unable to prove causality, or smaller studies without sufficient confounding control.¹

1.6 Pathways

The possible pathways between sexual violence and adverse health outcomes are becoming better understood and documented.¹ Figure 1 shows the hypothesised pathways between sexual violence and pregnancy and birth complications based on the WHO's conceptual framework regarding pathways and health effects from intimate partner violence.¹ The WHO suggests two main pathways, one direct and one indirect. The direct pathway involves injury to the woman that can lead to immediate complications such as miscarriage, ante partum haemorrhage, placental abruption, rupture of membranes and preterm birth.^{1,24,25,108,111} The indirect pathway is mediated by stress and stress responses.¹¹²⁻¹¹⁴ The literature provides evidence that the association between sexual violence and adverse health outcomes can be explained by neural, neuro-endocrine and immune responses to chronic and acute stress.^{26,113,115} It is shown that maternal exposure to stress can influence the hypothalamic-pituitary-adrenal (HPA) axis,¹¹⁴ which may cause a shift in cortisone levels that can create an autoimmune/inflammatory response with effects such as chronic pain syndromes and inflammatory conditions.¹¹⁶ Changes in these hormone levels may cause other negative outcomes such as premature delivery and foetal growth restriction.^{117,118}

A psychological pathway is suggested that proposes that adverse outcomes can be mediated by mental distress.^{1,119,120} This pathway may include conditions such as post-traumatic stress disorder (PTSD), somatisation, anxiety, fear of birth, an increased need for control and different birth strategies. Another indirect pathway is mediated by behavioural and other risk factors, and some women try to cope with the negative consequences of violence by using tobacco, alcohol or drugs,^{5,26,48} all of which are risk factors for poor health.⁴⁸ Eating disorders are also reported among abused women.¹²¹ Thus, some of the observed associations between sexual violence and adverse health may be related to these factors. Because most of the data on the health consequences of sexual violence are from cross-sectional studies, it is difficult to ensure the nature and direction of the relationship between sexual violence, the associated health-risk behaviour and the outcome.^{1,48} Some of the possible pathways are based on the assumption that sexual violence may cause a particular behaviour or cause stress/mental distress that in turn increases the risk of adverse pregnancy outcomes.^{1,48}

Figure 1. Model for possible pathways between lifetime sexual violence and adverse pregnancy outcome

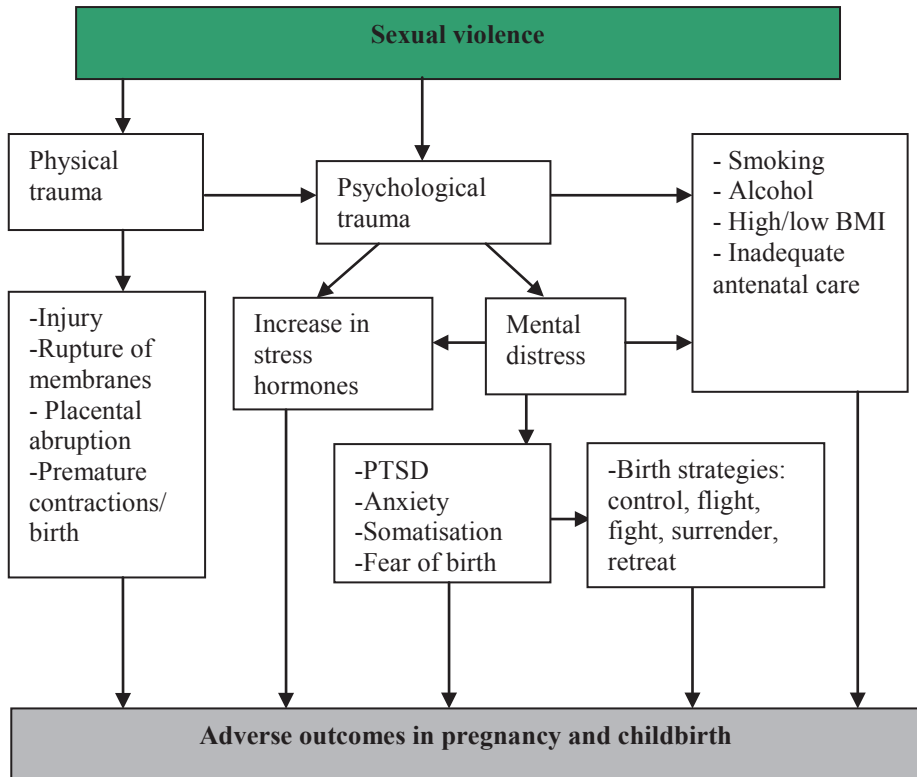


Figure 1 is an adapted model based on the conceptual framework and pathways in the 2013 WHO report: "Global and regional estimates of violence against women: prevalence and health effects of intimate partner violence and non-partner sexual violence".¹

1.7 Pregnancy-related physiological symptoms

Women can experience a variety of pregnancy-related symptoms such as nausea and vomiting, tiredness, backache, heartburn, constipation, vaginal discharge, leg cramps, oedema, headache, Braxton Hicks contractions, urinary incontinence, pelvic girdle relaxation, and urinary tract infections.^{122,123} The majority of these symptoms are considered normal results of physiological changes caused by pregnancy.¹²⁴⁻¹²⁷ Usually, these symptoms have no effect on the outcome of the pregnancy, but they may cause discomfort and anxiety to women. Occasionally, these normal discomforts may be symptoms of serious conditions.¹²⁷ Because of the association between sexual violence and general health as described in section 1.4, it is also likely that women who have experienced sexual violence report more of these complaints. Only two previous studies have investigated the association between

sexual violence and pregnancy-related physical symptoms.^{30,34} Both studies examined childhood sexual abuse and pregnancy-related complaints.

1.8 Hospitalisations during pregnancy

Even though pregnancy is generally considered a state of health rather than disease, pregnant women may experience severe complications due to both health risks before pregnancy and complications that occur during pregnancy.¹²³ There are several risk factors during pregnancy that require extra attention: hyperemesis; bleeding; hypertensive disorders; premature contractions; sexually transmitted infection; and medical disorders such as asthma, epilepsy and diabetes mellitus.¹²³ The prevalences vary between conditions and by when in pregnancy the conditions occur. For example, the prevalence of hyperemesis ranges from 0.8% to 3.2%,^{128,129} and approximately 8-12% of pregnant women are affected by hypertensive disorders.^{130,131} Some complications may lead to hospitalisation, and because the general trend in pregnancy care is toward outpatient care,¹³² a hospital admission suggests a complication of a certain degree of seriousness. In addition, hospitalisation generates costs in terms of both health expenditures and an added burden for women and their families.¹⁹ The prevalence of women being hospitalised during pregnancy for reasons other than childbirth varies; one population-based study from Canada, the results of which may be comparable to the situation in Norway, reports a prevalence of 5.7%.¹³³ The impact of sexual violence on antenatal hospitalisations has been poorly investigated. One study that investigated childhood sexual abuse found an increased risk for antenatal hospitalisations,²⁹ and there are studies that have found an association between IPV during pregnancy and antenatal hospitalisations.^{38,134, 135}

An important issue is that the prevalence of sexual violence is actually much higher than the prevalence of other pregnancy complications in some settings. Nevertheless, it receives considerably less attention within prenatal care.^{21,86}

1.9 Mode of delivery and maternal outcomes

The proportion of childbearing women that is defined as being high risk is increasing,¹³⁶ and technological developments are allowing pregnancies in women with conditions that previously prevented conception or successful pregnancies.¹³⁶ How clinicians address these complications differs, but there is global concern about the overuse of interventions.¹³⁷ Although advanced maternal age, multiple gestation and other medical factors can increase pregnancy complications, they do not fully explain the increased rate of interventions.¹³⁸ Unnecessary interventions during pregnancy and birth seem to be increased in high-income countries, which may cause further complications for women and newborns.¹³⁹ In addition, the economical costs of increased interventions are substantial.¹⁴⁰

The increased caesarean section rate is the main cause for concern.¹⁴¹ Rates greater than 10-15% are considered not beneficial to the health of the mother or child.^{142,143} The caesarean section rate exceeds this recommendation in all countries in the world with the exception of sub-Saharan Africa.¹⁴¹ While a CS may save the life of both mother and child, the surgery is not without the risk of short- and long-term complications.¹⁴⁴ Immediate complications include infections or thrombosis,¹⁴⁴ and long-term complications include increased risk of preterm birth, stillbirth, placenta accreta, bleeding and rupture of the uterus due to the operation performed in earlier pregnancies.¹⁴⁵

In Norway, the CS rate was 16.8% in 2012 with regional differences ranging from 12.8% to 21.7%.¹⁴⁶ In addition to the increase in risk factors among pregnant women in general,^{136, 138} improvements in anaesthetics and operative techniques and a lower threshold among obstetricians for performing CS¹⁴⁷ may have contributed to the increase in CS rates. Another suggested explanation is the change in how women participate in medical decision-making and their preferences for delivery.^{147,148} Some literature has suggested that the increase in maternal requests for CS may be partially due to fear of childbirth.^{147,149} An association between sexual violence and fear of childbirth has been reported.^{36,150} Women with a history of sexual violence may thus wish to have a CS because of their past negative experience.

Induction of labour is also an increasingly used intervention.¹⁵¹ In Norway, approximately 18% of all births are induced.¹⁵² In the case of both an elective CS and induction of labour, the start of birth is planned, which may be a way for women to have more control of the birth process. Control is one suggested coping mechanism for abused women during childbirth.¹⁵³ The bodily experience of childbirth may trigger memories of sexual abuse and affect a woman's ability to cooperate with staff in the second stage and thus may be associated with vaginal operative deliveries and perineal trauma, such as episiotomies and anal sphincter tears.¹⁵⁴

1.10 Neonatal outcomes

The neonatal outcomes investigated in this thesis are preterm birth, low birth weight and small for gestational age. Preterm birth is a common health problem,^{155,156} and prematurity is considered the leading cause of death for newborns.¹⁵⁶ Approximately one in ten babies are born preterm worldwide.¹⁵⁶ Low birth weight (LBW) can be a consequence of preterm birth (PTB) or intra uterine growth restriction, the latter leading to the birth of small for gestational age (SGA) infants.¹⁵⁷ There are some biological risk factors for PTB and LBW: multiple pregnancies, a previous preterm birth and uterine or placental abnormalities.^{156,157} Other important but less understood factors for PTB and LBW are behavioural and social factors,¹⁵⁶ including maternal age, socio-economic status, ethnicity, maternal weight, substance abuse, stress, depression and violence.^{117,155,156} The prevalence of preterm birth was 5.5% in Norway in 2011,¹⁵² a prevalence that has remained low and stable for the last decade.¹⁵⁸

2. Study aims

The overall aim of this study was to examine the effect of lifetime sexual violence on women's health during pregnancy and delivery. We wanted to examine whether a history of sexual violence was associated with adverse maternal and neonatal outcomes.

The following research questions were defined:

Paper:

- I {
 - What is the prevalence of sexual violence in the Norwegian Mother and Child cohort?
 - Are women with a history of sexual violence more affected by pregnancy-related physical symptoms than women without a history of sexual violence?
- II {
 - Are women who have been exposed to lifetime sexual violence hospitalised more frequently during pregnancy than non-exposed women?
 - Are there differences between exposed and non-exposed women regarding reasons for hospitalisations?
- III {
 - Is there an association between lifetime sexual violence and mode of delivery?
 - Do women with a history of sexual violence have more adverse maternal outcomes than non-exposed women?
- IV {
 - Are there differences in birth weight and gestational age among women exposed to sexual violence compared with women without such a history?
 - Do women who have been exposed to sexual violence have an increased risk of giving birth prematurely or giving birth to a child with low birth weight or a small for gestational age child?

3. Materials and methods

3.1 *The Norwegian Mother and Child Cohort study (MoBa)*

The Norwegian Mother and Child Cohort Study is a prospective population-based cohort study conducted by the Norwegian Institute of Public Health between 1999-2008.¹⁵⁹ The study was conceptualised in the 1990s, and the main aim of the study was to find causes of disease.¹⁵⁹ Pregnant women were recruited at the time of their routine ultrasound examination (approximately 17 weeks gestation). All pregnant women in Norway were eligible to participate in the study, and 40.6% of the invited women consented to participate. The MoBa leader group has upgraded the participation rate during the time we conducted these studies. Therefore, we had a participation rate of 38.7% in Papers I-III. The fathers of the children were also invited to participate. Data were collected from several questionnaires both in pregnancy and postpartum and from biological material. The cohort includes approximately 109 000 children, 91 000 women and 71 700 men. Additional information about the MoBa study can be found at the following web address: <http://www.fhi.no/studier/den-norske-mor-og-barn-undersokelsen>.

The participants in this study received a postal invitation at their routine ultrasound appointment. During pregnancy, the women answered questionnaires focused on demographic factors, general health, reproductive history and maternal health during pregnancy. We used questionnaire 1 (Q1), completed at approximately gestational week 17, and questionnaire 3 (Q3), completed at approximately gestational week 30. Data from the MoBa study were linked with data from the Medical Birth Registry of Norway (MBRN), a registry that maintains record of all deliveries in Norway based on a standardised form completed by midwives shortly after delivery.¹⁶⁰

This study is based on version VI of the quality-assured data files released for research in 2011.

3.2 *Exposure: Sexual violence*

The exposure variable was collected from Q1 and was used in all four papers included in this thesis. The women were asked if they had ever been pressured or forced into sexual relations. The answer options included the following: 1) No, never 2) Yes, pressured 3) Yes, forced with violence 4) Yes, raped. A positive answer was defined as having experienced sexual violence. Women with more than one positive answer were classified according to the most severe level of violence reported. The answer options were then recoded into mild, moderate and severe sexual violence. We used this terminology because it corresponds to other studies that have used validated instruments to study the prevalence of violence.⁵⁶ We recognise that all three answer options may be considered severe by the person who experienced the violence. A study unit in MoBa is a pregnancy, and a study unit in our study is a woman; therefore, we excluded pregnancies in women who

participated more than once. In so doing, we ensured that the exposure was counted only once for each woman.

Women could also indicate the timing of the violence at the following time periods: 1) during this pregnancy, 2) during the last six months before pregnancy or 3) earlier than six months before pregnancy. The 1 712 women who responded to the first version of Q1 had the option to answer ‘earlier’ and ‘during the last 12 months’. We therefore created the variables ‘previous’ and ‘recent sexual violence’, with the latter including sexual violence that occurred during last 12 months including the current pregnancy. Table 1 shows the questions on sexual violence in the MoBa study.

Table 3. Questions on sexual violence in The Norwegian Mother and Child Cohort Study (MoBa)
Version A, answered by 1 712 women:

Have you ever been pressured or forced into sexual relations? (Fill in one or several boxes.)		
	Last 12 months	Earlier
No, never.....	<input type="checkbox"/>	<input type="checkbox"/>
Yes, pressured.....	<input type="checkbox"/>	<input type="checkbox"/>
Yes, forced with violence.....	<input type="checkbox"/>	<input type="checkbox"/>
Yes, raped.....	<input type="checkbox"/>	<input type="checkbox"/>

The questions used in the other versions:

Have you ever been pressured or forced into sexual relations? (Fill in one or several boxes.)			
	During this pregnancy	Last 6 months before pregnancy	Earlier
No, never.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Yes, pressured.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Yes, forced with violence.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Yes, raped.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

All the questionnaires used in the MoBa study are available at the following web address: <http://www.fhi.no/studier/den-norske-mor-og-barn-undersokelsen/sporreskjemaer>.

3.3 Overview papers I-IV

Table 4 provides an overview of the sample, exposure, main outcome variable, covariates, design and statistical analysis in papers I-IV; the outcome measures and covariates are further described in sections 3.4 to 3.7.

Table 4. Overview papers I-IV

	Paper I	Paper II	Paper III	Paper IV
Sample	78 660	78 660	74 058	76 870
Exposure	Sexual violence	Sexual violence	Sexual violence	Sexual violence
Outcome variables	Pregnancy-related physical symptoms	Antenatal hospitalisations	Mode of delivery Maternal outcome	Gestational age, Birth weight
Covariates	Age, parity, education, occupation, civil status, smoking, alcohol, BMI, mental distress, child and adult physical abuse, child and adult emotional abuse, child and adult sexual abuse	Age, parity, education, occupation, civil status, smoking, alcohol, BMI, mental distress, child and adult physical abuse, child and adult emotional abuse	Age, parity, education, occupation, civil status, smoking, BMI, mental distress, child and adult physical abuse, child and adult emotional abuse, maternal diabetes, pre-eclampsia, macrosomia, previous CS, induction of labour, dystocia, epidural	Age, parity, education, smoking, BMI, mental distress, child and adult physical abuse, child and adult emotional abuse, spontaneous or provider-initiated start of labour
Design	Cross-sectional	Cross-sectional	Prospective cohort	Prospective cohort
Statistical analysis	Descriptive, Binary logistic regression	Descriptive, Binary logistic regression	Descriptive, Binary and multinomial logistic regression	Descriptive, Linear regression, Binary logistic regression

3.4 Paper I – Aim, design, study population, variables and statistical analysis

3.4.1 Aim

The aim of Paper I was to investigate whether a history of sexual violence was associated with pregnancy-related symptoms. In addition, we wanted to explore whether women with a history of sexual violence suffered longer or to a greater extent from the reported symptoms compared with women without such a history.

3.4.2 Design

Although MoBa is a cohort study, Paper I has a cross-sectional design. In this study, both the exposure and outcome data were collected at the same time.

3.4.3 Study population

Data were available on 92 838 pregnancies from Q1, Q3 and MBRN. Women were the observation unit in our study; we therefore excluded 13 475 pregnancies in women who participated more than once. We excluded 703 women who had not answered the question on sexual violence in Q1, yielding a study sample of 78 660 women

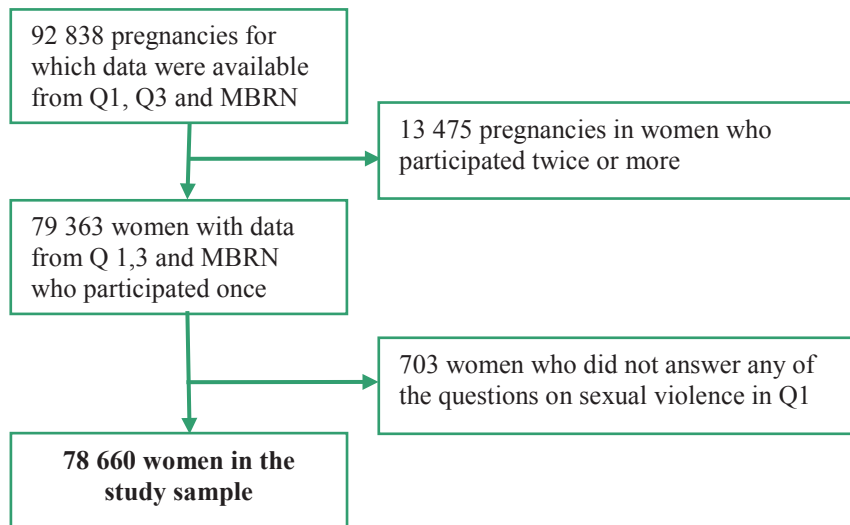


Figure 2. Flow chart for study I.

3.4.4 Outcome variables

Pregnancy-related physical symptoms: All symptoms were derived from MoBa, Q1 and Q3, except for Braxton Hicks contractions and leg cramps, which were only reported in Q3. Women indicated if they were “not at all”, “a little bothered” or “bothered a lot” by Braxton Hicks contractions. For the remaining physical symptoms—backache, tiredness, constipation, pelvic girdle relaxation, heartburn, nausea and vomiting, oedema, candidiasis, pruritus gravidarum, leukorrhoea, headache, urinary tract infection and urinary incontinence—women reported the number of 4-week periods during which they were bothered by each symptom. The number of 4-week periods women could choose varied from 8 for most symptoms (total of 32 weeks starting from 0–4 weeks of pregnancy) to 5 for leg cramps (only asked about in Q3, which started at 13–16 weeks of pregnancy).

3.4.5 Covariates

Age: Maternal age, defined as age in years at delivery, was taken from Q1. Age was considered a true confounding factor and included in all papers.¹⁶¹ In Paper I,

age was categorised into 5 groups: younger than 19 years, 20–25 years, 26–31 years, 32–37 years or 38 years and older.

Parity: Parity was taken from Q1 and defined as previous births after 21 completed weeks of gestation. Parity was dichotomised into nulli- and multiparous women. We have examined the effect of parity in all studies because parity is considered to be associated with the outcomes of interest in this thesis.¹⁶²

We used education and/or occupation as a proxy for socio-economical status. Low socio-economical status is considered a consistent predictor of both violence and pregnancy outcomes;^{85,163} therefore, we examined these factors in all the papers.

Education: Education was taken from Q1, and we used education in years categorised into 4 groups: primary (<12 years), secondary (12 years), ≤4 years beyond secondary (13–16 years and) and >4 years beyond secondary (≥17 years).

Occupation: In Q1, the women were given 11 possible choices for occupation: 1) student, 2) at home, 3) intern/apprentice, 4) military service, 5) unemployed/laid off, 6) rehabilitation/disabled, 7) employed in public sector, 8) employed in private sector, 9) self-employed, 10) family member without steady income in family company (e.g., farming, business) and 11) other. Three categories were made: student (including answer options 1 and 3), employed (including answer options 4, 7, 8, 9, and 10) and unemployed (including answer options 2, 5, and 6).

Civil status: The women were asked about their civil status in Q1, and the answers were coded as either married/cohabitant or single, which also included both divorced and widowed. We included civil status because research shows that being single is associated with an increased risk of being exposed to violence.⁸⁵

Pre-pregnancy body mass index (BMI): We controlled for BMI in all studies because both low and high BMI are considered to have adverse effects on pregnancy and childbirth,¹⁶⁴ and BMI is associated with the exposure.^{121,165} BMI, derived from Q1, was the pre-pregnancy BMI grouped into 4 categories: <20, 20-24.9, 25.0-29.9 or ≥30.0 kg/m².

Behavioural factors such as smoking and alcohol consumption are well-known factors associated with a history of violence.^{1,166,167} They are also known risk factors for several pregnancy-related physical symptoms and complications.^{123,124}

Smoking: Smoking was derived from Q1 and categorised as either smoking during pregnancy or not. Smoking during pregnancy included both daily and occasional smoking.

Alcohol: Alcohol consumption was taken from Q1 and dichotomised into any or no alcohol use during pregnancy.

Mental distress: Mental distress is associated with both sexual violence^{1,119,120} and pregnancy complications^{117,168} and was therefore included in all papers. The

Hopkins Symptom Checklist (SCL-5), which accounted for five items from Q3, was used to define symptoms of mental distress with a cut-off of ≥ 2.0 points, as suggested by Strand.¹⁶⁹

Other type of abuse: Because of the co-occurrence of different types of violence,⁵⁶ we examined the effect of physical and emotional abuse both as a child and as an adult. Information on adult physical violence was taken from Q1 and consisted of a positive answer to whether women had experienced being slapped, hit, kicked or otherwise bothered in a physical manner as an adult. Child physical violence was taken from Q3 and consisted of a positive answer to the question: “Did you experience physical violence before the age of 18?” Emotional abuse as a child (<18) or as an adult (≥ 18) consisted of a positive answer to either or both of the following questions in Q3: “Has someone over a long period of time systematically tried to subdue, degrade or humiliate you?” or “Has someone threatened to hurt you or someone close to you?” Child sexual abuse consisted of a positive answer to a question in Q3 in which women were asked if they had been pressured into sexual acts/activities as a child (<18 years). In addition, women were asked in Q3 if they had been pressured into sexual acts/activities as an adult (≥ 18 years). The sexual violence reported in Q1 could be the same act as the violence reported in Q3. Because the question on sexual violence is more detailed in Q1 and because its wording is less likely to include non-contact sexual abuse, we selected our exposure variable from Q1. Testing for collinearity between sexual violence reported in Q1 and sexual abuse reported in Q3 resulted in a Pearson’s correlation coefficient of 0.605, which is above the generally accepted cut-off of 0.4 for including the variable as a covariate in regression analyses.¹⁷⁰ Due to this overlap and collinearity, sexual abuse from Q3 was not entered in the regression models.

3.4.6 Statistical analysis

Frequency analyses were used to quantify the prevalence of each level of sexual violence. Cross-tabulations and Pearson’s chi-square tests were used to study percentages and to assess differences in demographic and other characteristics for women reporting sexual violence compared with women not reporting sexual violence. Binary logistic regression analyses were conducted to estimate the crude and adjusted ORs, the 95% CIs for the association between the different levels of sexual violence, and the 90th percentile of the number of 4-week periods of suffering for each pregnancy-related physical symptom. To estimate the independent associations between sexual violence and the reporting of pregnancy-related physical symptoms, we adjusted for the other types of violence and abuse reported, as well as age in all adjusted models provided there were enough cases (model 1). We made two additional models. In model 2, we adjusted for mental distress. In model 3, we added the a priori selected covariates: pre-pregnancy BMI, parity, smoking and alcohol consumption in early pregnancy. We also examined the association between the timing of the abuse and suffering from 8 or more pregnancy-related symptoms. The comparison group for all analyses was women not reporting sexual violence in all four studies. All analyses were two-sided at α 0.05 and conducted with the statistical program SPSS version 18.0 or 19.0.

3.5 Paper II – Aim, design, study population, variables and statistical analysis

3.5.1 Aim

We studied whether a history of sexual violence was associated with an increase in antenatal hospitalisations. We also explored the reasons for hospital admissions.

3.5.2 Design

Paper II has a cross-sectional design.

3.5.3 Study population

Figure 2 in section 3.4.3 shows the study population. The total sample comprised 78 660 women.

3.5.4 Outcome variables

Antenatal hospitalisation during pregnancy: Information on antenatal hospitalisations was derived from two composite questions in Q3. The women answered an overall question about whether they had been hospitalised during pregnancy. As part of this question, they were asked to select one or more reasons for hospitalisation from the following options: prolonged nausea and vomiting (hyperemesis), bleeding, leaking of amniotic fluid, threat of preterm birth, high blood pressure, pre-eclampsia and other. Due to overlap, high blood pressure and pre-eclampsia were recoded into one variable called hypertensive disorders. The 1 063 women who answered “yes” to the overall question about hospitalisation without giving any specific reason were classified as “Admitted without reported reason”.

In addition, women could indicate the time periods during which they were hospitalised; they selected 4-week periods from 0–4 to 29+ weeks gestation. The variable “Admitted more than once for different reasons” included women who reported admission in two time periods for different reasons. “Admitted more than once for the same reason” consisted of women who reported admission in two or more time periods for same reason.

3.5.5 Covariates

The following covariates were included in this study: parity, education, occupation, civil status, use of alcohol, smoking during pregnancy, BMI, mental distress and other types of abuse as described in section 3.4.5.

3.5.6. Statistical analysis

Frequency analysis was used to quantify the proportion of the different levels of sexual violence and the prevalence of the different outcomes. Cross-tabulations and Pearson’s chi-square tests were used to assess differences in characteristics between

women who were and were not hospitalised. Fisher's exact tests were used when the assumptions for the chi-square test were not met. The associations between exposure variables and the outcomes were estimated as crude and adjusted ORs using binary logistic regression analyses with 95% CIs.

In the preliminary analysis, we controlled for potential confounding factors and other covariates: socio-demographic characteristics (age, parity, education, occupation and civil status); behavioural factors (smoking and alcohol), BMI and other types of abuse. These factors are all considered to be associated with a history of violence and are also known risk factors for pregnancy-related complications that can lead to hospitalisation.^{99,171-173} Age, parity, BMI, mental distress and other types of abuse were kept in the final adjusted models. The other covariates did not influence the OR.

3.6 Paper III– Aim, design, study population, variables and statistical analysis

3.6.1 Aim

The primary aim was to investigate whether a history of sexual violence was associated with the mode of delivery. We also examined the association between sexual violence and selected maternal outcomes.

3.6.2 Design

Paper III was a population-based cohort study in which women were followed from approximately gestational week 17 until they gave birth.

3.6.3 Study population

Only full term births were included in this study. Figure 1 describes the inclusion and exclusion criteria. The study sample comprised 74 058 women.

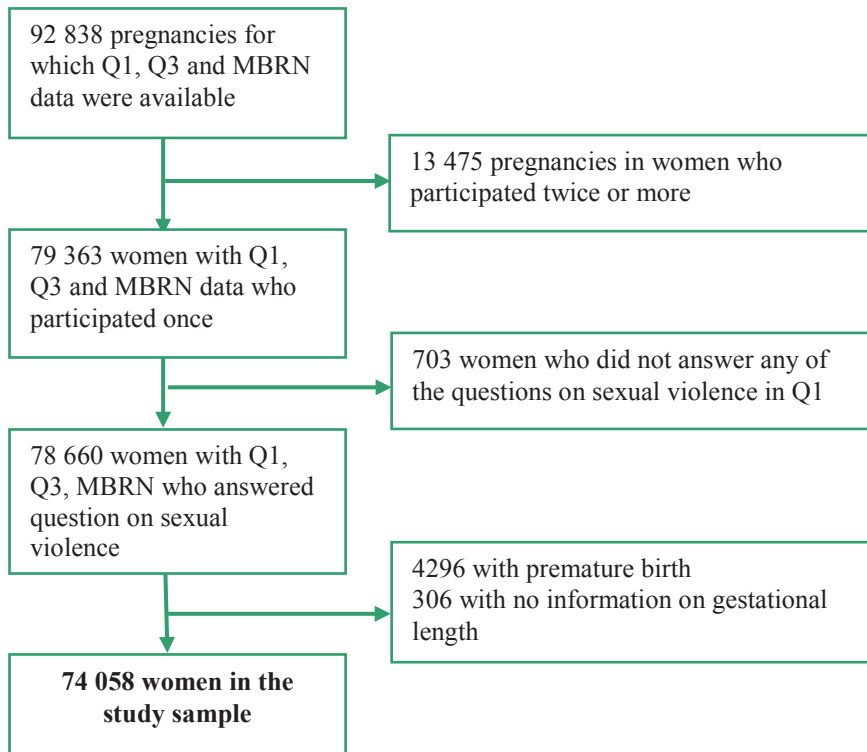


Figure 3. Flow-chart for study III:

3.6.4 Outcome variables

Mode of delivery: All outcome variables were obtained from the MBRN. The mode of delivery was classified as spontaneous birth, instrument-assisted vaginal delivery (vacuum- or forceps-assisted births), elective caesarean section (CS) and emergency CS. Elective CS included CSs that were planned >8 hours prior to delivery. Emergency CS included all other caesarean deliveries.

Other maternal outcomes: Induction, epidural, dystocia, episiotomy and anal sphincter tears were also studied. Dystocia was recoded from a variable in MBRN that consisted of the following: dystocia, foetopelvic disproportion, abnormal labour and augmentation.

3.6.5 Covariates

Age: We controlled for younger (<20 years) and older (≥ 35) maternal age because both are associated with mode of delivery and other birth outcomes.^{151,174}

Parity: Parity was obtained from the MBRN and coded as nulli- and multiparous women. In this study, we stratified for parity because nulli- and multiparous women are considered to be different in terms of both mode of delivery and the other outcomes. The majority of other studies that have addressed the same outcomes have examined nulliparous women only, and by stratifying, we were able to compare our study to the others.

The following variables were also included: education, occupation, civil status, use of alcohol, smoking during pregnancy, BMI, mental distress and other types of abuse.

Other risk factors: We included risk factors that were considered to be associated with mode of delivery and the different maternal outcomes.^{138,151} Information about these variables was obtained from the MBRN and included pre-eclampsia, maternal diabetes (all types), macrosomia (birth weight over 4.5 kg) and previous CS for multiparous women. Induction, dystocia and epidural were considered covariates associated with the mode of delivery when they were not the outcome of interest.

3.6.6 Statistical analysis

Cross-tabulations, Pearson's chi-square tests and linear-by-linear associations were used to calculate percentages and to assess differences in demographic and obstetric factors for women with a history of mild, moderate and severe sexual violence. Multinomial logistic regression analysis was used to examine the association between sexual violence and mode of delivery. Univariable models with the mode of delivery as the dependent variable and mild, moderate and severe sexual violence as the independent variables were performed first. The adjusting variables were then added in sequence to the preliminary univariable models. Variables were included in a multivariable model if they were associated with either of the outcomes with a p-value of 0.1 or less. Variables that retained a significant association with either of the outcomes in this step were included in the final models. A p-value <0.05 was the level of inclusion for the adjusting variables in the final multivariable models. Binary logistic models were similarly performed, with the dependent variables comprising binary variables.

3.7 Paper IV– Aim, design, study population variables and statistical analysis

3.7.1 Aim

In this study, we assessed the relationship between sexual violence and both gestational age at birth and birth weight. Additionally, we explored the associations between sexual violence and PTB, LBW and SGA.

3.7.2 Design

Paper IV was a population-based cohort study.

3.7.3 Study population

Figure 4 shows the inclusion and exclusion process for this study. The study sample comprised 76 870 women.

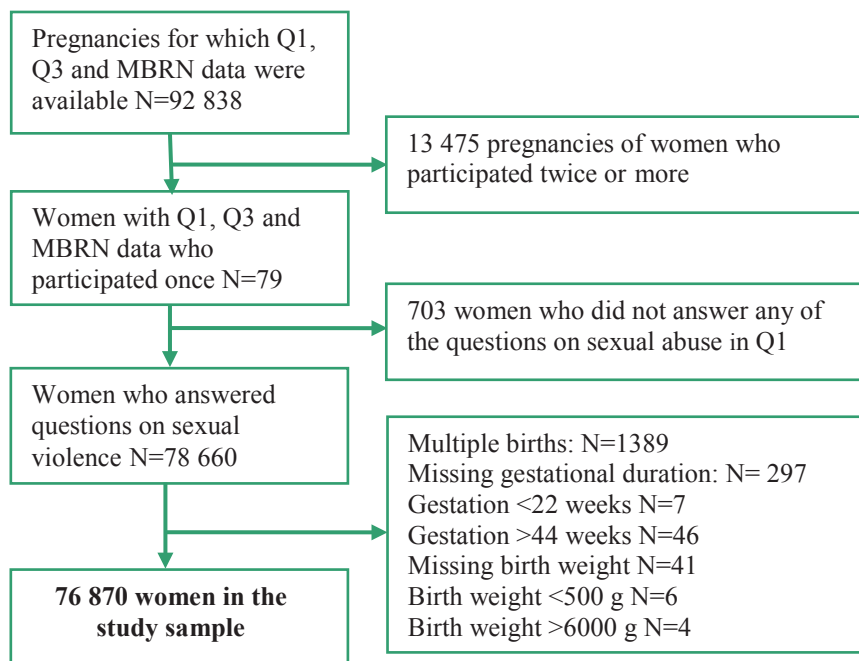


Figure 4. Flow-chart for study IV

3.7.4 Outcome variables

Neonatal outcomes: Neonatal outcomes were obtained from the MBRN. Gestational age at birth in days was based on ultrasound at approximately gestational week 18. For women with no ultrasound (1.7%), the gestational age was based on the last menstrual period. PTB was defined as gestational age <37 weeks, LBW as a birth weight <2500 grams, and SGA as birth weight below the 10th percentile for gestational age at birth. SGA was calculated using the Norwegian-specific foetal growth tables by Skjervén et al.¹⁷⁵

3.7.5 Covariates

We used the following socio-demographic and behavioural variables: age, parity, education, smoking and BMI. In this study, age was categorised into 5 groups: younger than 20 years, 20–24 years, 25–29 years, 30–34 years or 35 years and older. In addition, we controlled for mental distress and other type of violence and abuse.

3.7.6 Statistical analysis

Frequency analysis and cross-tabulation were used to assess characteristics that were presented as percentages within the entire sample and the different outcomes. Linear regression was conducted to assess differences in birth weight and gestational age for children born to women with and without a history of mild, moderate and severe sexual violence. The association between sexual violence and PTB, LBW and SGA was estimated with crude and adjusted OR using binary logistic regression analyses. All analyses were adjusted for maternal age, parity, education, smoking, BMI and mental distress in the first step. Birth weight was additionally adjusted for gestational age. We further adjusted for other types of violence in the second step.

We stratified the sample into spontaneous start of birth and provider-initiated start of birth (induced start of birth or elective caesarean section) for gestational age because a provider-initiated start could influence the gestational age at birth. Information on the initiation of delivery was taken from the MBRN.

3.8 Missing

In all studies, the prevalence of missing data was less than 4% for all variables except alcohol consumption, for which the prevalence of missing data was approximately 12%. The missing data for alcohol consumption were recoded into a dummy variable and included in the regression as a categorical variable to prevent the exclusion of a large number of women from the analysis. Because missing data was not a significant problem, no imputing methods for missing data were used¹⁷⁶ except for the missing data for the SCL-5 (approximately 3%), which were replaced by the series mean. The results of the logistic regression analyses remained approximately the same when performed with the complete exclusion of missing data compared with using the imputed missing data for SCL-5.

3.9 Ethics

The MoBa study was approved by the Regional Committee for Medical Research Ethics and the Norwegian Data Inspectorate. All participants were informed about the purpose of the study and that their participation in the study was voluntary. Each participant signed a written consent approving the use of the data provided for research purposes and linking of the data with the MBRN. The participants were free to withdraw from the study at any time. All personal identifiers were removed in the main database, and no personal data were sent to the researchers.

Some of the participants may have found some questions intrusive, and the inclusion of questions on sexual violence was a controversial issue in the MoBa study. The participants were asked to complete the questionnaires as fully as possible, but they were not contacted if any of the questions were incomplete. The ethical considerations regarding MoBa were addressed in special meetings prior to the start of the study. One concern was the safety of the women that may live with a violent partner. The safety of the respondents is paramount when examining violence.¹⁷⁷ Therefore, questions that included the partner as the perpetrator were excluded to reduce the risk for women filling out the questionnaires if they were living with an abusive partner. The recruiting hospital provided contact information to women upon request.

No intervention was done in the MoBa study, and this reduced potential disadvantages. Questions about sensitive topics, such as sexual violence, may contribute to negative feelings including self-blame, stigmatisation or humiliation.¹⁷⁸ Nevertheless, studies show that women are willing to answer questions about abuse and they report meaningfulness about their participation in studies with questions about sensitive topics.¹⁷⁹

4. Results

4.1 Prevalence of sexual violence

The prevalence of sexual violence is presented in figure 5, including the overall prevalence of mild, moderate and severe sexual violence and the prevalence of recent exposure (within the last 12 months).

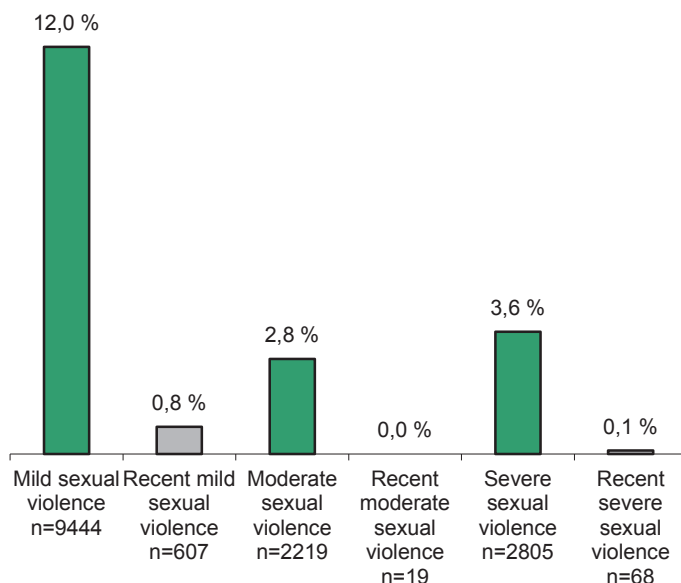


Figure 5. Prevalence of sexual violence

4.2 Summary of results

4.2.1 Paper I: Sexual violence and pregnancy-related physical symptoms.

Women who reported a history of sexual violence were significantly younger, more often unemployed and less frequently living with a partner. They more frequently reported smoking and alcohol consumption during early pregnancy, BMI ≥ 30 and mental distress. In addition, they were more likely to report other types of violence and abuse both as a child and as an adult. Sexual violence was significantly associated with increased suffering from pregnancy-related physical symptoms, measured both by the number of symptoms and by the duration/degree of suffering. Compared with women not reporting sexual violence, the probability of suffering from ≥ 8 pregnancy-related symptoms estimated by adjusted odds ratio (AOR), was 1.49 (95% CI 1.41–1.58) for women reporting a history of mild sexual violence, 1.66 (1.50–1.84) for moderate sexual violence and 1.78 (1.62–1.95) for severe

sexual violence. Women who reported severe sexual violence both previously and recently had the highest OR of suffering from ≥ 8 pregnancy-related symptoms (AOR 6.70 (2.34–19.14)).

4.2.2 Paper II: Sexual violence and antenatal hospitalisations.

A history of sexual violence was associated with significantly more hospitalisations during pregnancy: 6.6% for mild sexual violence, 8.7% for moderate sexual violence and 12.5% for severe sexual violence, compared with 5.8% among women who reported no sexual violence. Women were admitted significantly more often for hyperemesis, bleeding, threat of preterm birth, other reasons, and without giving any reason. Women who reported severe sexual violence had an AOR for being hospitalised with hyperemesis and threat of preterm birth of 1.9 (95% CI 1.4-2.5) and 1.9 (1.3-2.7), respectively. Similarly, women who were exposed to severe sexual violence had almost a two-fold chance of being admitted more than once during pregnancy (AOR 1.9 (1.3-2.7), compared with non-exposed women.

4.2.3 Paper III: Sexual violence and mode of delivery.

A total of 10% of the women had an operative vaginal birth, 4.9% underwent elective caesarean section (CS), and 8.6% underwent emergency CS. Severe sexual violence was associated with elective CS (AOR 1.56 (95% CI 1.18-2.05) for nulliparous women and 1.37 (1.06-1.76) for multiparous women). Those women who were exposed to moderate sexual violence had a higher risk of emergency CS, with an AOR of 1.31 (1.07-1.60) and 1.41 (1.08-1.84) for nulli- and multiparous women, respectively. No association was found between sexual violence and operative vaginal birth, except for a lower risk among multiparous women reporting mild sexual violence (AOR 0.73 (0.60-0.89)). The analyses of other maternal outcomes showed a reduced risk of episiotomy for women reporting severe sexual violence and a higher frequency of induced labour. Nulliparous women who reported sexual violence had a reduced risk of having an anal sphincter tear compared with non-exposed women.

4.2.4 Paper IV: Sexual violence and neonatal outcome

A total of 4.7% of the sample had a premature birth, 2.7% had children with a birth weight < 2500 gram and 8.1% had children who were small for gestational age. Women who reported both moderate and severe sexual violence had a significantly reduced gestational duration with approximately 2 days when the start of birth was provider-initiated in an analysis adjusted for age, parity, education, smoking, BMI and mental distress. Those women who were exposed to severe sexual violence had a significantly reduced gestational duration of 0.51 days with a spontaneous start of birth. There was no significant association between sexual violence and PTB, LBW or SGA in the adjusted analysis.

5. Discussion

5.1 *Main findings*

5.1.1 Paper I

Women with a history of sexual violence suffered from more pregnancy-related physical symptoms, of a greater severity and for a longer time, compared with women who did not report such a history.

5.1.2 Paper II

Women with a history of sexual violence were hospitalised more often during pregnancy than women without such a history. The strongest associations were shown for hyperemesis, preterm contractions and being admitted with no particular reason.

5.1.3 Paper III

Severe sexual violence was associated with a higher risk of elective CS and moderate sexual violence with an increased risk of emergency CS. An association between sexual violence and vaginal operative birth was significant for multiparous women exposed to mild sexual violence showing a decreased risk. Women reporting severe sexual violence had a higher risk of induction and a lower risk of episiotomy. Nulliparous women with a history of sexual violence had fewer anal sphincter tears.

5.1.4 Paper IV

Moderate and severe sexual violence were associated with a reduction in gestational age at birth. There was no significant association between sexual violence and PTB, LBW or SGA in the adjusted analysis.

5.2 *Consideration of methodology*

5.2.1 Strengths and limitations of the studies

A major advantage of our studies is the large sample size, which generally assures narrow CIs and minimises the likelihood of type-II errors. The validity of the data in MoBa has been described in earlier research as sufficient for large-scale epidemiological studies.¹⁸⁰⁻¹⁸³ The Medical Birth registry of Norway is quality assessed¹⁶⁰ and provides prospectively collected data.

Our studies have limitations. Even with the large study sample in MoBa, some subgroups of women were small. For studying differences between these groups, the statistical power may be limited. For example, only a few women experienced both recent and previous sexual violence, and therefore, the CIs around risk estimates for

some of these analyses were wide. In some analyses, there were not enough cases to control for the a priori chosen covariates. Other limitations are discussed in each paper and will also be systematically discussed further in this chapter. The basic question regarding methodological consideration is whether the results are valid. Validity is usually separated into two components: internal and external validity.¹⁶¹ Internal validity refers to the accuracy of the findings within the study sample, and external validity refers to whether the findings can be projected to larger or other populations (generalisability).¹⁶¹ The validity can be threatened by errors in measurement that are random or systematic. Using adequate sample size is the primary way of reducing random error. Selection bias, information bias and confounding are the main causes of systematic error.¹⁶¹

5.2.2 Selection bias

Selection bias arises when the participants in the study differ from non-participants.¹⁶¹ In the MoBa study, 40.6% of the invited women agreed to participate, and we lack information about the women who did not participate. The questionnaires in the MoBa study are extensive, and participating in the study involved considerable effort. In addition, women were asked for blood samples, and they did not receive any compensation for participating, which might explain the low response rate. Women who participated in the MoBa study were older, had more education and lower parity, smoked less and were less likely to be of a non-Norwegian origin than the overall Norwegian population.¹⁵⁹ These differences introduce a socio-economic gradient that may have influenced the prevalence estimates. This gradient may have affected the prevalence of sexual violence, and although 18.4% of the participants reported sexual violence, the prevalence may be different in the unselected population. A study that examined the prevalence of abuse among pregnant women in six European studies supports our findings,⁷⁵ with a prevalence of lifetime sexual violence of 17.7% among the Norwegian participants. Similar to the MoBa study, the participating women reported higher education levels than the general population in Norway.⁷⁵ A new study from Norway reported a rape prevalence of 9.4%,⁵⁸ which is more than twice as high as our finding. A new population-based study from Sweden showed that one in ten women have been exposed to severe sexual violence as adults, and approximately 28% have experienced mild sexual violence.⁵⁹ This year, the European Union (EU) published results from their study on violence against women in the general population in each EU Member State.⁶⁰ The prevalence of rape in this study was 5%. The questions that were used to examine the exposure in these studies were based on validated instruments, and the findings suggest that sexual violence may be slightly higher in the general Norwegian population than in our study. If this is the case, it may have diminished our results. It is unlikely that women declined to participate due to the questions about sexual violence. Sexual violence was not the focus of this study, and they were most likely unaware that these questionnaires were included when they agreed to participate. In our sample, only 703 women declined to answer the questions regarding sexual violence.

A study by Nilsen et al found that even if prevalence estimates were affected, there was no evidence that the exposure-outcome associations were affected by selection bias.¹⁸²

5.2.3 Information bias

Information bias can occur because of errors in the measurements of study variables and can be caused by errors in data collection, recording, coding or possessing of the data.¹⁶¹ For discrete variables, measurement error is usually called classification error or misclassification.¹⁶¹ Misclassification can be differential or non-differential. A differential misclassification occurs when the classification of the outcome is dependent upon the status of the exposure or vice-versa. A non-differential misclassification is not dependent on other variables.¹⁶¹

Lack of precision in measurement: The use of general subjective questions regarding sexual violence can cause misclassification because these general labels may not match the way participants think about their experience. The use of more specific and detailed questions is a strategy to ensure precision in measurement and thus prevent misclassifications.^{54,184}

The measurement of the outcome in studies I and II also lack precision. In questions in study I regarding physical symptoms in pregnancy, women reported the number of 4-week periods during which they were bothered by each symptom. Our measurement does not allow us to discern whether they were bothered once in this period or throughout the entire period. The same lack of precision in measurement is present in questions regarding hospitalisation in study II, where women could choose the number of 4-week periods during which they were hospitalised. In addition, women had seven pre-defined options regarding the reasons for being admitted that did not necessarily match the women's experience. More options may have prevented misclassifications. A more precise measurement tool for the self-reported outcomes in studies I and II might have yielded a stronger association between sexual violence and both pregnancy-related symptoms and hospitalisations during pregnancy.

Information bias in the measurement of the exposure: The MoBa study used a non-validated set of questions to measure sexual violence. Under-reporting is always a possibility when attempting to measure rates of sexual violence.^{54,185} Using questions that describe specific actions that respondents may have experienced is thought to reduce under-reporting.^{184,186} An example of this type of question from the EU study on violence against women from 2014 follows:⁶⁰

Since you were 15 years old until now/in the past 12 months, how often has someone: forced you into sexual intercourse by holding you down or hurting you in some way? (IF NEEDED ADD: By sexual intercourse we mean here oral sex, forced anal or vaginal penetration)(page 40).⁶⁰

The gold standard for measuring the prevalence of violence is considered to be specialised surveys with trained interviewers.¹ Violence measured in modules as part

of a larger questionnaire,¹ like in the MoBa study, may achieve a lower disclosure rate. Over-reporting of violence is not likely,¹⁸⁷ and studies indicate that few women report being exposed to violence if this is not the case.¹⁸⁸ Unwillingness to report sexual violence among women classified as non-exposed may have caused a misclassification that diminished the associations between sexual violence and the outcomes in our studies.

Information bias regarding the outcomes: In Papers I and II, the outcomes were self-reported, and recall-bias may have been present. Nevertheless, women were asked about episodes that happened in the current pregnancy, thus reducing the likelihood of recall bias. Being hospitalised is most likely an event women remember. A differential misclassification regarding the exposure may have occurred if the women who were hospitalised spent a long time thinking of reasons for being hospitalised (e.g., related it to past experiences) and thus reported more sexual violence. This situation is unlikely, especially because over-reporting of sexual violence is uncommon,¹⁸⁷ and questions about the exposure were at the end of a long questionnaire, whereas the questions regarding health in pregnancy were at the beginning and thus not related to each other. Recall bias may also be present for questions regarding the pregnancy-related physical symptoms; because these symptoms are quite common among pregnant women without a clear definition, both under-reporting and over-reporting of the symptoms may be present. The misclassification can be differential because women with a history of sexual violence report more mental distress in our studies, and mental distress is associated with health perceptions that may cause women to over-report problems in pregnancy.^{68,189}

Information bias regarding the outcomes in studies III and IV are not likely, as both the maternal and neonatal outcomes used were taken from the MBRN and thus collected after the exposure. The data from the MBRN is based on information provided after birth, usually by the midwife attending the birth. Although missing data, incorrect information and misclassification problems might be an issue, several studies have confirmed that the information in the registry is of generally good quality.¹⁹⁰⁻¹⁹³ If misclassification is present regarding the outcomes in Papers III and IV, it is very likely non-differential.

5.2.4 Confounding

A confounding variable is associated with both the outcome and the exposure without being a consequence of the exposure.^{161,176} Confounding factors may create a spurious association or may mask a real association between the exposure and the outcome. A confounding factor is not an intermediate step in the causal pathway between the exposure and the outcome.^{161,176} There are several strategies for dealing with the bias that can be caused by confounding: restriction, stratification and controlling for the confounding factors in regression analyses.^{161,176} We have used all three strategies in our studies. In paper III, we excluded women with a multiple pregnancy and women who gave birth preterm because these factors could influence the mode of delivery and we stratified for parity. For all the papers, we performed logistic regression analyses in which we controlled for potential confounding

factors. Age and socio-economic factors were considered to be true confounding factors. We also examined the effect of parity in all studies. Parity is connected with age but also with the different outcomes.¹⁶²

The reviewers for Papers III and IV questioned our choice of controlling factors, especially mental distress and health risk behaviours such as smoking and BMI because they may be on the pathway between sexual violence and adverse outcomes. We did control for mental distress because a bi-directional relationship between mental distress and violence is described.¹¹⁹ BMI and smoking are strongly associated with pregnancy outcomes,^{123,124} therefore, we chose to control for these factors.

5.2.5 External validity

External validity concerns the extent to which the findings can be generalised from the specific sample in the study to a target population.¹⁷⁶ The issue of external validity in our studies is whether our findings are valid for the Norwegian population. In this thesis, we used data from the MoBa study in which nearly all pregnant women were invited to participate. Nevertheless, the external validity is threatened by the low participation rate (40.6%). As suggested earlier, a possible selection bias is present, but studies have shown little evidence for bias in the exposure-outcome associations.¹⁸² This finding indicates little reason for concern about selection bias threatening the generalisability to the Norwegian population except for immigrant populations in Norway. These groups are under-represented in MoBa because participating in the study required good Norwegian language skills.

5.2.6 Causal inference

Causality is the relationship between a cause and an outcome where the outcome is understood as a consequence of the cause.^{161,176} In 1965, the English epidemiologist, Sir Austin Bradford Hill, proposed a list of nine criteria when discussing the causality of an association.¹⁹⁴ When considering causality, *temporality* is important, and the cause must come before the effect. In cross-sectional studies, the time dimension is not present, and this concern needs to be taken into consideration when assessing causality. Papers I and II in this thesis have a cross-sectional design. In Papers III and IV, the temporal relationship of the association is assured because exposed women were exposed to sexual violence before the outcomes. Another aspect is the *strength* of an association, and in our studies, the significant ORs range from 1.2 to 6.7. The strongest association was found between experiences of both recent and previous severe sexual violence (rape) and the reporting of ≥ 8 physical symptoms. The weakest associations were found between a history of sexual violence and emergency CS, induction and use of epidural. However, as Rothman notes, having a weak association does not rule out causality.¹⁶¹ The third criterion, *consistency*, has been discussed in all of our papers with examples from other studies that support our findings. The association between sexual violence and ill health is generally well documented.¹ The findings in Paper IV are less consistent with other studies. We did not find an association between sexual violence and

preterm birth/low birth weight, which stands in contrast to three meta-analyses.^{1,195,196} that have shown an association between violence in general and preterm birth/low birth weight. A *biological gradient* is present in Papers I and II, where a dose-response relationship between the exposure and outcome was observed—the strength of the association increased with the increasing severity of sexual violence. In paper III, some of the findings lacked a dose-response relationship, and caution is therefore needed in the interpretation of causality for these findings. The associations that we have shown are *plausible* and *coherent* with the current theory and possible pathways between sexual violence and ill health. Hill also emphasises *specificity*—either that one cause leads to a single effect or that one effect has a single cause. Specificity does not apply to our studies because sexual violence is associated with several negative effects, and our outcomes may have several causes. *Experimental evidence* is another criterion that does not apply to our studies.

5.3 Interpretation of the results

Increased risk of pregnancy-related physical symptoms and hospitalisations during pregnancy

In our studies, women who have been exposed to sexual violence were more likely than non-exposed women to report pregnancy-related physical symptoms and hospitalisations during pregnancy. Our results confirm the results from studies that have examined the consequences of physical and/or sexual violence in pregnancy and one year prior to pregnancy^{31,134,135} and studies that have examined associations between child sexual violence and pregnancy complications.^{29,30,34} It is well documented that abuse leads to physical and psychological health problems.^{12,89,91,92,94,197-199} The factors that create this association are not clear, but some studies note that violence leads to changes in the nervous system or an excess of stress hormones, which contributes to future health problems among abused women.²⁰⁰ We have suggested this pathway in our model of possible pathways (figure 1), and the results in Papers I and II supports this proposal. The stress of being exposed to violence triggers both an acute and a chronic stress response, which affect the HPA-axis.^{114,197} Studies of childhood sexual abuse have shown dysregulation of the HPA-axis among those women exposed to abuse,^{201, 202} and one study of adult victims of sexual violence documented a difference in the immune/inflammatory functioning compared with non-exposed controls.²⁰³

We have suggested a psychological pathway in our model, and psychological factors may increase the reporting of pregnancy complications.^{68,189} This pathway includes mental distress, which can lead to conditions such as hyper-vigilance, somatisation and anxiety, and researchers suggest an association between these factors and poor self-reported health.^{172, 197,204,205} Because women who have experienced sexual violence are more likely to evaluate their health as poor,^{91, 206} it is not unlikely that they report more pregnancy-related complaints or complications that may lead to hospitalisations. Stress and anxiety can lead to excessive concern about the body,

and minor physical changes can be amplified into severe concerns for the women.^{197,207} Some studies suggest that current life stressors have a stronger effect on increasing health problems for women who have been exposed to violence than for non-exposed women.^{208,209} For some women, pregnancy may be one such life stressor. In addition, some of these women may engage in riskier health behaviours that cause complications.

Depression and anxiety are particularly common among women exposed to violence,^{119, 197} findings confirmed by our study. When we controlled for mental distress, the ORs changed by approximately 10% in studies I and II, with smaller or no changes in studies III and IV.

What can explain the association between sexual violence and maternal outcomes, including mode of delivery?

There is a lack of consensus in the literature on whether lifetime sexual violence is associated with mode of delivery and other maternal outcomes.^{15,30,32,36,71,72,76,103,107-109} However, different mechanisms may explain the associations found in our studies. Rhodes & Hutchinson have described four different birthing styles among women who have been exposed to sexual violence: fighting, taking control, surrendering and retreating.¹⁵⁴ These different birth styles may lead to different outcomes. For example, the fighting and retreating strategy may affect a woman's ability to cooperate with staff in the second stage and thus be associated with outcomes such as vaginal operative deliveries and perineal trauma. Taking control can explain why exposed women in our study have more elective CSs and inductions. A provider-initiated start of birth may help abused women remain in control over the birthing process. Other studies have also emphasised the meaning of control and the importance for abused women to remain in control.¹⁵³ A study by Hobbins suggests that the triggering of sexual violence memories during birth causes physiological mechanisms that can interfere with contractions.²¹⁰ This interference may lead to a prolonged second stage and cause providers to perform an emergency CS. Simkin²¹¹ described birth behaviours among women with a history of abuse that include anxiety over body boundaries and fear of invasive procedures, which may explain why exposed women in our study had fewer episiotomies and why multiparous women exposed to mild sexual violence experienced fewer vaginal operative births. Whether women expressed this anxiety during birth or whether the birth attendants were aware of a history of sexual violence and tried to avoid invasive procedures is not known in our study.

Studies suggest that fear of childbirth is connected with CS,^{147,149, 212} and an association between a history of sexual violence and fear of childbirth is shown.^{36,73,150,213,214} This phenomenon may also contribute to the association between a history of sexual violence and elective CS.

Sexual violence and neonatal outcomes

An association between intimate partner violence that includes physical and/or sexual violence and neonatal outcomes is described in three different meta-analyses that found associations between IPV/PTB and IPV/LBW.^{1,195,196} The suggested pathways presented in Figure 1, in contrast to our study, support the findings of the meta-analyses. Comparison is difficult because of the different exposures, and physical violence may be a factor in the association. We were able to control for physical abuse, and this step did not change the ORs in our study. In addition, Norway most likely has a lower prevalence of both PTB and LBW than the settings of the studies included in the meta-analyses, which were mostly conducted in the United States. The prevalence of PTB and SGA in the MoBa study is slightly lower than in the general population,¹⁵² most likely due to the socio-economic gradient,¹⁵⁹ and this difference may have affected the outcome in our study. One Norwegian case-control study by Grimstad et al.,³⁰ which included 82 women who had an infant with LBW and 90 controls, did not find a significant association between child sexual abuse and LBW. There are other single studies that support our findings, including a Canadian population-based study with a sample of 6 421 pregnant women¹⁰⁴ and a cohort study that included 1 555 women from the United States.⁴⁰ The exposure in these studies was physical and sexual violence prior to pregnancy and in pregnancy without being limited to intimate partner violence.^{40,104}

Sexual violence during pregnancy

The timing of violence did not influence the results in our studies except for pregnancy-related physical complaints. We found a strong association between pregnancy-related physical symptoms and both recent and previous sexual violence (a 7-fold increase in OR). In our study, sexual violence was assessed in approximately gestational week 17, and events of violence after that have been missed. Some studies suggest that the risk of sexual violence may increase over the course of pregnancy for women who are exposed.¹⁹⁶ The studies that report the highest prevalence of violence have measured exposure to violence several times during pregnancy.²⁰ The prevalence of sexual violence during pregnancy is low, and under-reporting may have decreased the power to detect an association between violence during pregnancy and adverse outcomes, an association that is supported by other studies.^{38,41,134, 195, 215}

Perpetrator, context and nature of the violence

The nature of the exposure measured in the MoBa study makes it difficult to directly compare our findings to the findings of other studies, mainly because we examined lifetime sexual violence by any perpetrator, not limited to intimate partners. Regardless of the perpetrator, sexual violence is considered traumatic for the victim.^{50,51,216} When an intimate partner is the perpetrator, sexual violence may be accompanied by controlling behaviour and may include both physical and emotional abuse in addition to sexual violence.² It may also be part of a pattern that persists

over a long time period. Rape by strangers is usually a single, violent event with a higher risk of physical injury. Both forms of violence are associated with adverse health effects.^{1,2,34} We were not able to examine the effect of the perpetrator in our studies because of the lack of information regarding who performed the violence. However, research suggests that a substantial proportion of sexual violence occurs within an intimate relationship,⁴⁹ and it is likely that the majority of the sexual violence in the MoBa study was perpetrated by an intimate partner. Considering the wording in the questions regarding the exposure, severe sexual violence (rape) may primarily reflect non-partner sexual violence, while mild sexual violence (pressured into sexual acts) may reflect IPV and be of a more psychological nature. Nevertheless, all answer options regarding the exposure fall under the WHO's definition of sexual violence.⁴³ The use of a more comprehensive instrument when measuring the exposure with multiple response options regarding context, frequency and perpetrator would have clarified the nature of the violence further.

5.4 Clinical implications

This thesis shows that a history of sexual violence is common among pregnant women in Norway and that women with a history of sexual violence are at greater risk than non-exposed women for experiencing more complications during pregnancy and that sexual violence may affect the mode of delivery. When women enter antenatal care, it is likely that they have not disclosed the violence. However, if ongoing violence or a history of violence is uncovered, clinicians may help to prevent or ease complications and unnecessary interventions. The Norwegian government has decided to introduce routine inquiry to assess IPV and a history of abuse among pregnant women.²¹⁷ The WHO also highlights antenatal care as an opportunity to ask women about violence because of the vulnerability of pregnancy.²¹⁸ They recommend that health-care providers ask about exposure to violence when assessing conditions that may be caused or complicated by intimate partner violence.²¹⁸ When women present many pregnancy-related health complaints or are hospitalised without a clear reason, health professionals should be aware that a history of sexual violence or other abuse may be present. Health-care workers need to be trained to respond to the disclosure of a history of violence as well as to learn to recognise the possible consequences of sexual violence. Health risk behaviours such as smoking, substance abuse or eating disorders may also be conditions associated with sexual violence. It is possible that these factors are the result of prior exposure to violence. Antenatal care may offer opportunities for women to receive help, not only if they are exposed to violence but also in providing assistance to change behavioural factors contributing to adverse outcomes regardless of whether they disclose a history of violence.

5.5 Future research

In past research, sexual violence has often been investigated as part of IPV or combined with physical violence² (e.g., in the AAS). Instruments are needed to

capture the prevalence and effect of sexual violence itself, including the effect of the nature, context and perpetrator—important aspects of sexual violence that should be examined further. Research on non-partner violence has increased less than research on IPV.² Most evidence regarding the health effects of non-partner sexual violence currently comes from clinical research or case-control studies,^{1,54} and longitudinal studies are needed to establish temporality to be more certain of causality.^{1,54,194} Another important issue for further research is the investigation of resilience and support mechanisms, which are present among many abused women, and the effect of therapy or treatment for preventing future ill health.

6. Conclusions

In this thesis, which was based on a large population-based cohort study among pregnant women, we noted the following findings:

- Women who had experienced lifetime sexual violence were more likely to experience pregnancy-related physical symptoms, measured in terms of both number of symptoms and duration/degree of suffering.
- Severe sexual violence (rape) was associated with antenatal hospitalisations, caesarean section and induction of labour. Women who had been exposed to sexual violence had a reduced risk of having an episiotomy, and exposed nulliparous women were less likely to have an anal sphincter tear.
- A history of sexual violence was not associated with preterm birth, low birth weight or small for gestational age children.

7. Errata

Paper III: The study sample is 74 058. A total of 306 women with no information on gestational duration were excluded in addition to 4 296 women who gave birth prematurely.

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9. Appendix

The MoBa study:

The questionnaires are extensive and easily accessible and therefore not included in full in this thesis. They can be found at the following web address:

<http://www.fhi.no/studier/den-norske-mor-og-barn-undersokelsen/sporreskjemaer>.

The letter of information and consent can be found at:

<http://www.fhi.no/studier/den-norske-mor-og-barn-undersokelsen/forskning-og-datatilgang>

Notification form:
Medical Birth Registry of Norway, December 1998-present



Melding om avsluttet svangerskap etter 16. uke – Fødsel, dødfødsel, spontanabort

Se utfyllingsinstruks for blanketten på baksiden



A - Stille opplysninger	Institusjonsnr: <input type="text"/>	Institusjonsnavn: <input type="text"/>	Fødsel utenfor institusjon: <input type="checkbox"/> Hjemme, planlagt <input type="checkbox"/> Hjemme, ikke planlagt <input type="checkbox"/> Under transport <input type="checkbox"/> Annet sted	Mors fulle navn og adresse: <input type="text"/>	
	Mors sivilstatus: <input type="checkbox"/> Gift <input type="checkbox"/> Samboer <input type="checkbox"/> Ugift/enslig <input type="checkbox"/> Skilt/separert/enke <input type="checkbox"/> Annet	Slektskap mellom barnets foreldre? <input type="checkbox"/> Nei <input type="checkbox"/> Ja, hvis ja, hvorledes: <input type="text"/>	Mors bokommune: <input type="text"/>	Pikenavn (etternavn): <input type="text"/>	
B - Om svangerskap og mors helse	Fars fødselsdato: <input type="text"/>	Fars fulle navn: <input type="text"/>	Mors fødselsnr: <input type="text"/>		
	Siste menstr. i. blodn.dag: <input type="text"/>	<input type="checkbox"/> Sikker <input type="checkbox"/> Usikker	Mors tidligere svangerskap/fødsle: Levende-fødsle: <input type="text"/> Dødfødsle (24. uke og over): <input type="text"/> Spontanabort/Dødfødsle (12-23 uke): <input type="text"/> Spontanaborter (under 12. uke): <input type="text"/>		
C - Om fødselen	Ultraljud utført? <input type="checkbox"/> Nei <input type="checkbox"/> Ja, UL termin: <input type="text"/>	Annen prenatal diagnostikk? <input type="checkbox"/> Nei <input type="checkbox"/> Ja, angi type: <input type="text"/>	Regelmessig kosttilskudd: <input type="checkbox"/> Nei <input type="checkbox"/> Ja, for sv.sk. i sv.sk. Multivitamin <input type="checkbox"/> Folat/Folsyre <input type="checkbox"/> Annet, spesifiser i «B» <input type="text"/>	Spesifikasjon av forhold for eller under svangerskapet: <input type="checkbox"/> Nei <input type="checkbox"/> Ja, hvis bekreftet – spesifiser <input type="text"/>	
	Spesielle forhold for svangerskapet: <input type="checkbox"/> Intet spesielt <input type="checkbox"/> Astma <input type="checkbox"/> Allergi <input type="checkbox"/> Tidligere sectio <input type="checkbox"/> Res. urinveisinfeksjon <input type="checkbox"/> Blødning < 13 uke <input type="checkbox"/> Blødning 13-28 uke <input type="checkbox"/> Blødning > 28 uke <input type="checkbox"/> Glukosuri <input type="checkbox"/> Svangerskapsdiabetes	Kronisk nyresykdom <input type="checkbox"/> Epilepsi <input type="checkbox"/> Diabetes type 1 <input type="checkbox"/> Diabetes type 2 <input type="checkbox"/> Annet, spesifiser i «B» <input type="checkbox"/> Eklamsi <input type="checkbox"/> Hb < 9.0 g/dl <input type="checkbox"/> Hb > 13.5 g/dl <input type="checkbox"/> Trombose, beh. <input type="checkbox"/> Infeksjon, spes. i «B» <input type="checkbox"/> HELLP syndrom	Legemidler i svangerskapet: <input type="checkbox"/> Nei <input type="checkbox"/> Ja – spesifiser i «B» <input type="text"/>		
D - Om barnet	Røyking og yrke Forutsetter mors samtykke – se rettledning på baksiden <input type="checkbox"/> Skriftlig orientering gitt til mor <input type="checkbox"/> Samtykker ikke for røykeoppl. <input type="checkbox"/> Samtykker ikke for røykeoppl. avslutning?	Røykte mor ved sv.sk. begynnelse? <input type="checkbox"/> Nei <input type="checkbox"/> Av og til <input type="checkbox"/> Daglig <input type="checkbox"/> Ant. sig. dagl.: <input type="text"/>	Mors yrke <input type="checkbox"/> Samtykker ikke for yrkesoppl. <input type="checkbox"/> Ikke yrkesaktiv <input type="checkbox"/> Yrkesaktiv heltid <input type="checkbox"/> Yrkesaktiv deltid	Mors yrke: <input type="text"/> Bransje: <input type="text"/>	
	Leie/presentasjon: <input type="checkbox"/> Normal bakhode <input type="checkbox"/> Sete <input type="checkbox"/> Tvertleie <input type="checkbox"/> Avvikende hodefødsel <input type="checkbox"/> Annet, spesifiser i «C»	Fødselstakt: <input type="checkbox"/> Spontan <input type="checkbox"/> Indusert <input type="checkbox"/> Sectio	Ev. induksjonsmetode: <input type="checkbox"/> Prostaglandin <input type="checkbox"/> Oxytocin <input type="checkbox"/> Amniotomi <input type="checkbox"/> Annet, spesifiser i «C»	Indikasjon for inngrep og/eller induksjon: <input type="checkbox"/> Komplikasjoner som beskrevet nedenfor <input type="checkbox"/> Fostermidnanner <input type="checkbox"/> Overtid <input type="checkbox"/> Annet, spesifiser i «C»	
E - Om fødselen	Inngrep/tiltak: <input type="checkbox"/> Ingen <input type="checkbox"/> Utskj. tang, hodeleie <input type="checkbox"/> Annen tang, hodeleie <input type="checkbox"/> Vakuumekstraktor <input type="checkbox"/> Episiotomi	Fremhj. ved setefødsel: <input type="checkbox"/> Vanlig fremhjelp <input type="checkbox"/> Uttrekning <input type="checkbox"/> Tang på etterk. hode	Sectio: <input type="checkbox"/> Var sectio planlagt før fødsel? <input type="checkbox"/> Utført som elektiv sectio <input type="checkbox"/> Utført som akutt sectio	Spesifikasjon av forhold ved fødselen/andre komplikasjoner: <input type="checkbox"/> Nei <input type="checkbox"/> Ja <input type="checkbox"/> Truende intrauterin asfyksi <input type="checkbox"/> Risvekkelse, stimulert <input type="checkbox"/> Langsom fremgang <input type="checkbox"/> Uterus atoni <input type="checkbox"/> Annet: <input type="text"/>	
	Komplikasjoner: <input type="checkbox"/> Ingen <input type="checkbox"/> Vannavg. 12-24 timer <input type="checkbox"/> Vannavg. > 24 timer <input type="checkbox"/> Mekaniske misforhold <input type="checkbox"/> Vanskelig skulderforlesning	Placenta previa <input type="checkbox"/> Abruptio placentae <input type="checkbox"/> Perinealruptur (grad 1-2) <input type="checkbox"/> Sphincteruptur (gr. 3-4)	Blødning > 1500 ml, transf. <input type="checkbox"/> Blødning 500-1500 ml <input type="checkbox"/> Eklamsi under fødsel <input type="checkbox"/> Navlesnorfremfall <input type="checkbox"/> Paracervical blokk <input type="checkbox"/> Narkose <input type="checkbox"/> Annet: <input type="text"/>		
F - Om fødselen	Anestesi/analgesi: <input type="checkbox"/> Ingen <input type="checkbox"/> Lystgass <input type="checkbox"/> Petidin	Epidural <input type="checkbox"/> Spinal	Pudendal <input type="checkbox"/> Infiltrasjon	Paracervical blokk <input type="checkbox"/> Narkose <input type="checkbox"/> Annet: <input type="text"/>	
	Placenta: <input type="checkbox"/> Normal <input type="checkbox"/> Hinnerester <input type="checkbox"/> Ufullstendig <input type="checkbox"/> Infarkter	Koagler <input type="checkbox"/> Utskrapping <input type="checkbox"/> Manuell uthenting <input type="checkbox"/> Placenta-vekt: <input type="text"/>	Navlesnor: <input type="checkbox"/> Normal <input type="checkbox"/> Velamentøst feste <input type="checkbox"/> Marginalt feste <input type="checkbox"/> Karanomalier	Omslyng rundt hals <input type="checkbox"/> Annet omslyng <input type="checkbox"/> Ekte knute <input type="checkbox"/> Navlesnorlengde: <input type="text"/>	Fostervann: <input type="checkbox"/> Normal <input type="checkbox"/> Polyhydramnion <input type="checkbox"/> Oligohydramnion <input type="checkbox"/> Misfarget <input type="checkbox"/> Stinkende, infisert <input type="checkbox"/> Blodtilblandet
G - Om fødselen	Komplikasjoner hos mor etter fødsel: <input type="checkbox"/> Intet spesielt <input type="checkbox"/> Feber > 38.5° <input type="checkbox"/> Trombose <input type="checkbox"/> Eklamsi post partum <input type="checkbox"/> Mor overflyttet <input type="checkbox"/> Mor intensivbeholdt <input type="checkbox"/> Sepsis <input type="checkbox"/> Annet, spesifiser <input type="text"/>				
	Fødselsdato: <input type="text"/>	Klokken: <input type="text"/>	Pluralitet: <input type="checkbox"/> Enkeltfødsel <input type="checkbox"/> Flertfødsel	For flertfødsel: Nr. <input type="text"/> Av totalt <input type="text"/>	Kjønn: <input type="checkbox"/> Gut <input type="checkbox"/> Pike Barnets vekt: <input type="text"/> Ved tvil spesifiser i «D» <input type="text"/>
H - Om barnet	Barnet var: <input type="checkbox"/> Levendefødt <input type="checkbox"/> Dødfødt/sp.abort Oppgi dødsårsak i «D» <input type="text"/>	For dødfødsel: <input type="checkbox"/> Død før fødsel <input type="checkbox"/> Død under fødselen <input type="checkbox"/> Ukjent dødstidspunkt	For dødfødsel, oppgi også: <input type="checkbox"/> Død før innkommst <input type="checkbox"/> Død etter innkommst	Levendefødt, død innen 24 timer Livet varte: <input type="text"/> timer <input type="text"/> min.	Død senere (dato): <input type="text"/>
	Overfl. barneavd. <input type="checkbox"/> Nei <input type="checkbox"/> Ja	Dato: <input type="text"/>	Overfl. til: <input type="text"/>	Indikasjon for overflytting: <input type="checkbox"/> Respirasjonsproblem <input type="checkbox"/> Prematur <input type="checkbox"/> Medfødte misd. <input type="checkbox"/> Perinatale infeksjoner	Behandlingskode: <input type="checkbox"/> Systemisk antibiotika <input type="checkbox"/> Respiratorbeholdt <input type="checkbox"/> CPAP beholdt
I - Om barnet	Neonatale diagn.: (Fyller ut av lege/pedialter) <input type="checkbox"/> Intet spesielt <input type="checkbox"/> Hypoglyk. (< 2 mmol/l) <input type="checkbox"/> Medf. anemi (Hb < 13.5 g/dl) <input type="checkbox"/> Hodeleddssysp. beh. m.pute	Transit. tachypnoe <input type="checkbox"/> Resp. distress syndr. <input type="checkbox"/> Aspirasjonsyndrom <input type="checkbox"/> Intrakraniell blødning	Cerebral irritasjon <input type="checkbox"/> Cerebral depresjon <input type="checkbox"/> Abstinens <input type="checkbox"/> Neonatale krampes	Konjunktivitt beh. <input type="checkbox"/> Navle/hudinf. beh. <input type="checkbox"/> Perinat. inf. bakteriell <input type="checkbox"/> Perinat. inf. andre	Fract. clavicularae <input type="checkbox"/> Annen fraktur <input type="checkbox"/> Facialisparese <input type="checkbox"/> Plexusskade
	Tegn til medfødte misdannelser: <input type="checkbox"/> Nei <input type="checkbox"/> Ja	Spesifikasjon av skader, neonatale diagnoser og medfødte misdannelser – utfyller av lege <input type="checkbox"/> D			
J - Om barnet	Kryss av hvis skjema er oppfølgingsskjema <input type="checkbox"/>	Jordmor vifødsel: <input type="checkbox"/>	Jordmor vutskrivning: <input type="checkbox"/>	Leges barse/barneavd.: <input type="checkbox"/>	Utskrivningsdato: Mor: <input type="text"/> Barn: <input type="text"/>
	Protokollnr.: <input type="text"/>	Leges:	Leges:	Leges:	

RESEARCH ARTICLE

Open Access

Sexual violence and pregnancy-related physical symptoms

Mirjam Lukasse^{1,2*}, Lena Henriksen³, Siri Vangen⁴ and Berit Schei^{1,5}

Abstract

Background: Few studies have investigated the impact of sexual violence on health during pregnancy. We examined the association between sexual violence and the reporting of physical symptoms during pregnancy.

Methods: A population-based national cohort study conducted by The Norwegian Mother and Child Cohort study (MoBa) collected data from pregnant women through postal questionnaires at 17 and 32 weeks gestation. Three levels of sexual violence were measured: 1) mild (pressured into sexual relations), 2) moderate (forced with violence into sexual relation) and 3) severe (rape). Differences between women reporting and not reporting sexual violence were assessed using Pearson's χ^2 test and multiple logistic regression analyses.

Results: Of 78 660 women, 12.0% (9 444) reported mild, 2.8% (2 219) moderate and 3.6% (2 805) severe sexual violence. Sexual violence was significantly associated with increased reporting of pregnancy-related physical symptoms, both measured in number of symptoms and duration/degree of suffering. Compared to women not reporting sexual violence, the probability of suffering from ≥ 8 pregnancy-related symptoms estimated by Adjusted Odds Ratio (AOR) was 1.49 (1.41–1.58) for mild sexual violence, 1.66 (1.50–1.84) for moderate and 1.78 (1.62–1.95) for severe. Severe sexual violence both previously and recently had the strongest association with suffering from ≥ 8 pregnancy-related symptoms, AOR 6.70 (2.34–19.14).

Conclusion: A history of sexual violence is associated with increased reporting of pregnancy-related physical symptoms. Clinicians should consider the possible role of a history of sexual violence when treating women who suffer extensively from pregnancy-related symptoms.

Keywords: Sexual violence, Rape, Pregnancy, Physical complaints

Background

Sexual violence comprises a wide range of sexual violent acts. According to the World Health Organization (WHO) sexual violence includes any sexual act or attempt to obtain a sexual act using coercion [1]. Coercion may involve physical force, psychological intimidation and threats [1]. Sexual violence includes rape, traditionally defined as vaginal, anal or oral sexual intercourse obtained through force or threat of force [1,2]. However, more recently the recognition has developed that

coercion may not always be present or essential for sexual violence to occur. Therefore newer definitions of rape and sexual violence have replaced the term coercion by lack of consent, thus including sexual violence that occurs through the inability to give consent, for example due to intoxication [3,4].

The lifetime prevalence of sexual violence among nationally representative samples of women in the USA ranges from 18.0% for rape [5,6] to 27.2% for unwanted sexual contact [6]. Population-based studies from Australia, Sweden and Norway report a prevalence ranging from 8.1 to 13.3% [7-10], while WHO in their multi-country study reported a lifetime prevalence ranging from 6.2% in Japan to 58.6% in Ethiopia [11]. Prevalence estimates vary, depending on the population studied, investigation methods used, response rate achieved and how rape was defined [12].

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Risk factors for experiencing sexual violence are young age, high-risk behavior including alcohol/substance misuse, and other violence such as intimate partner or domestic violence [5,13,14]. A history of sexual violence has been associated with a wide range of psychological and physical complaints as well as medical diagnoses including post-traumatic stress disorder, depression, anxiety disorders, eating disorders, somatization disorders, chronic pain such as headaches, abdominal pain, fibromyalgia and pelvic pain, gastro-intestinal symptoms and sexually transmitted diseases [8,15-18]. Women who have experienced sexual violence are more likely to report poor quality of health compared to women without a history of abuse [15-18]. Women's pre-pregnancy health, health perception and negative health behaviors are likely to continue during pregnancy thus affecting pregnancy and pregnancy outcome [9].

Even though an uncomplicated pregnancy is generally considered to be a state of health rather than disease, it is frequently accompanied by so called "minor symptoms" of pregnancy, such as nausea and vomiting, tiredness, backache, heartburn, constipation, vaginal discharge, leg cramps, edema, headache, Braxton Hicks contractions, urinary incontinence, pelvic girdle relaxation, and urinary tract infections [19-21]. These symptoms are primarily the result of physiological changes caused by pregnancy and usually have no bearing on the outcome of pregnancy [19,21]. They are subjective and may be difficult to substantiate objectively.

As far as we know only two previous studies have investigated the association between sexual abuse and pregnancy-related physical symptoms [22,23]. In both studies the sexual abuse was limited to abuse during childhood. The aim of our study was to investigate if a history of sexual violence is associated with the number of pregnancy-related symptoms women report. In addition we wanted to explore whether women with a history of sexual violence suffered to a greater extent from the reported symptoms, compared to women without such a history.

Material and methods

Design and population

The Norwegian Mother and Child Cohort Study (MoBa study) conducted by the Norwegian Institute of Public Health is a nationwide cohort study [24]. This large-scale study was not based on any single or even set of hypotheses, but aimed to estimate the association between a large number of exposures and outcomes [24]. A large group of researchers was involved in the planning of the study and developing the questionnaires. In order to include many possible relevant exposures some validated instruments were included in a shortened and modified version while other questions were specifically

developed for this study. The study collected data from pregnant women using three extensive questionnaires.

From 1999 to 2009 the majority of all pregnant women were invited to participate through a postal invitation. Of all the women giving birth in Norway during the inclusion period, approximately 40% participated in the MoBa study, of which 92% completed both questionnaires used in our data analysis. This present study is a cross-sectional study using data from the cohort study and included 92 838 pregnancies, comprising women who returned both the first and the third questionnaire (Q1 at 16–20 and Q3 at 30–34 weeks gestation). We subsequently excluded 13 475 pregnancies of women who had participated twice or more (i.e. only a woman's first pregnancy was included) and 703 women who had not responded to any of the questions on sexual abuse in Q1, leaving a total of 78 600 women for analyses. Informed consent was obtained from each participant. The Regional Committee for Medical Research Ethics (Regional Komité for Forskningsetikk Helseregion II, Ref.SAFH95/313RTL) and the Norwegian Data Inspectorate approved the study. The safety of participants potentially involved in ongoing abuse was ensured by the following measures. Recruiting hospitals were able to care for participants and if necessary refer them to other institutions thereby ensuring the safety of participants potentially involved in ongoing abuse. The aim of the MoBa study is, as the invitation to participate explained, to study factors influencing general and obstetric health. The questions on violence and abuse were therefore not expected, either by the participants or their partners. In addition, these questions were not immediately apparent as they were placed at the end of a long questionnaire.

Variables

The exposure variable came from Q1, measuring sexual violence at 3 levels of severity. Women were asked if they ever had been pressured or forced into sexual relations. Answering options were: 1) No, never; 2) Yes, pressured (mild); 3) Yes, forced with violence (moderate); 4) Yes, raped (severe). A positive answer was defined as having experienced sexual violence. Women with more than one positive answer were classified according to the most severe level reported. For each of the 4 answering options women could indicate when the sexual violence had occurred (Figure 1). The format of this question was changed slightly after version 1 of Q1 (Figure 1). All versions of Q1 had the answering option "earlier", which we coded as previously. The answering option "during the last 12 months", from version 1 of Q1, was coded as recent sexual violence, as were the options "during this pregnancy" and "during the last 6 months before pregnancy" from all subsequent versions of Q1.

Have you ever been pressured or forced to have sexual relations? (Tick off one or several boxes)			
Answering options for all versions of Q1 except the first (76 948 women)			
	In this pregnancy	Last 6 months before pregnancy	Earlier
No, never.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Yes, pressured.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Yes, forced with violence.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Yes, raped.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Have you ever been pressured or forced to have sexual relations? (Tick off one or several boxes)		
Answering options to the first version of Q1 (1712 women)		
	During the last 12 months	Earlier
No, never.....	<input type="checkbox"/>	<input type="checkbox"/>
Yes, pressured.....	<input type="checkbox"/>	<input type="checkbox"/>
Yes, forced with violence.....	<input type="checkbox"/>	<input type="checkbox"/>
Yes, raped.....	<input type="checkbox"/>	<input type="checkbox"/>

Figure 1 Questions about sexual violence in Q1, questionnaire 16–20 weeks gestation, in Norwegian mother and child cohort study.

The physical complaints were derived from both Q1 and Q3, except for Braxton Hicks contractions and leg cramps, which were only reported in Q3. Women indicated if they were “not at all”, “a little bothered” or “bothered a lot” by Braxton Hicks contractions. For the remaining physical symptoms, women reported how many 4-week periods they were bothered by each symptom. The number of 4-week periods women could tick off, varied from 8 for most symptoms (total of 32 weeks starting from 0–4 weeks of pregnancy) to 5 for leg cramps (only Q3, started from 13–16 weeks of pregnancy).

Information on adult physical violence was taken from Q1 and consisted of a positive answer as to whether women as adults had experienced being slapped, hit, kicked or otherwise physically assaulted. This question and the ones on physical violence and emotional abuse from Q3 are modified questions derived from the Norvold Abuse Questionnaire (NorAq) [25].

Child physical violence from Q3 consisted of a positive answer to the question “Have you experienced physical violence before the age of 18?”. Emotional abuse either as a child (<18 years) or as an adult (≥18 years), also from Q3, was a positive answer to one or both of two descriptive questions: 1) Have you experienced anybody, systematically and over a long period of time, trying to repress, degrade or humiliate you? 2) Have you experienced anybody threatening to hurt you or someone close to you? In Q3 women were asked if they had been pressured into sexual acts/activities either as a child (<18 years) or as an adult (≥18 years). The sexual violence reported in Q1 could very well, but not necessarily, be that reported in Q3. As the question on sexual violence is more detailed in Q1 and as its wording is less

likely to include non-contact sexual abuse we selected our exposure variable from Q1. To differentiate between these similar variables from Q1 and Q3, the term sexual abuse is used for Q3 and sexual violence for Q1.

The Hopkins Symptom Checklist using 5 items (SCL-5), from Q3, was used to measure mental distress, using a 2.0 cut-off point as suggested by Strand et al. [26]. The SCL-5 had been translated into Norwegian and validated in Norway [27]. Socio-demographic and other characteristics such as age, education, parity, civil status, occupation, consumption of alcohol or smoking during pregnancy, height and pre-pregnancy weight were derived from Q1. Any report of smoking or alcohol use during pregnancy was coded as positive for these variables.

Statistical analyses

Frequency analyses were used to quantify the prevalence of the different levels of sexual violence at different time periods. Cross-tabulation and Pearson's chi-square test were used to study percentages and assess differences in the prevalence of demographic and other characteristics for women reporting sexual violence compared to women not reporting sexual violence.

There were no significant differences for missing data by level of severity of sexual violence. The prevalence of missing data was 2.1% for BMI, 3.7% for education, 0.5% for civil status, and 0.7% for smoking during pregnancy. Missing data for the SCL-5 (3.2%) was replaced by the series mean. Sensitivity analyses comparing the total score of SCL-5 before and after imputation showed no significant differences. The results of the logistic regression analyses remained qualitatively the same when

performed with complete exclusion of missing data compared to using imputed missing data for SCL-5.

In a clinical setting without routine enquiry about a history of violence, women rarely inform their doctor or midwife about such a history [10,28]. However, women who complain “excessively” of pregnancy-related physical symptoms may be noticed. We therefore aimed at analyses which would identify those women from the total sample. We did this by defining a cut-off for the number of 4-week periods women were suffering from the different symptoms using the 90th percentile of the distribution for the whole sample. The same procedure was used to define the cut-off for the number of pregnancy-related physical symptoms. This identified women who reported 8 or more symptoms.

The questions enquiring about sexual violence in Q1 and sexual abuse in Q3 are not the same, yet very similar. This explains why among the 9 114 women reporting childhood and/or adult sexual abuse in Q3, 7 577 (83.1%) also reported any sexual violence in Q1. Testing for collinearity between sexual violence reported in Q1 and sexual abuse reported in Q3 resulted in a Pearson's correlation coefficient of 0.605, well above the generally accepted cut-off of <0.4 for entering as a covariate in the regression analyses. Due to the overlap and collinearity shown, sexual abuse from Q3 was not entered in the regression analyses models.

Binary logistic regression analyses were performed to estimate the crude and adjusted OR and 95% CI for the association between the different levels of severity of sexual violence and the 90th percentile of the number of 4-week periods of suffering for each pregnancy-related physical symptom. Age was considered the only true confounding factor and controlled for in all the models [29]. The literature shows that co-occurrence of violence is common [17]. In order to estimate the independent association between the sexual violence and the reporting of pregnancy-related physical symptoms, we adjusted for the other types of violence and abuse reported, as well as age in all adjusted models, provided there were enough cases. Mental distress has been associated with sexual violence and we considered it to be a mediating factor [17]. In *Model 1* we adjusted for age and other types of violence and abuse. In *Model 2* we additionally adjusted for mental distress to estimate the importance

of this mediating factor. Finally, in *Model 3*, we added the a priori selected covariates: pre-pregnancy BMI, parity, smoking and alcohol consumption in early pregnancy to those included in *Model 2*. The covariates added to *Model 3* are all well-known factors associated with a history of abuse and violence [30-34]. They are also known risk factors for several of the pregnancy-related physical symptoms [35-38]. *Model 3* investigates the importance of these factors. The comparison group for all analyses was women not reporting sexual violence. All analyses were two-sided at α 0.05 and conducted with the statistical program SPSS version 19.0.

Results

Twelve percent (9 444) of the women reported mild sexual violence, 2.8% (2 219) moderate and 3.6% (2 805) severe (Table 1). Of the 14 468 women who reported sexual violence ever, 94.4 % reported having experienced this only previously, 1.6% only recently and 4% both recently and previously.

Women reporting a history of sexual violence were significantly younger, more often unemployed and less frequently living with a partner (Table 2). In addition they more frequently reported smoking and alcohol consumption during early pregnancy, a BMI ≥ 30 and mental distress (Table 2). Women reporting sexual violence were significantly more likely to report other types of violence and abuse, both as a child and as an adult (Table 2). One thousand five hundred and thirty seven (1 537) women reported sexual abuse in Q3 without reporting sexual violence in Q1, of these, 1 134 reported childhood sexual abuse and 429 adult sexual abuse.

All through pregnancy the proportion of women suffering from pregnancy-related physical symptoms was significantly higher among women with a history of sexual violence compared to women without such a history. Already at 0–4 weeks, 45% of the women with a history of severe sexual violence reported suffering one or more pregnancy-related physical symptoms, compared to 33.3% for women not reporting sexual violence ($P > 0.001$). At 21–24 weeks and 29–32 weeks, the proportion of women reporting suffering one or more symptoms had risen to 80.5% and 79.2% respectively for women reporting a history of sexual violence compared to 71.7% and 72.5% for those without a history of sexual

Table 1 Prevalence of sexual violence in the Norwegian mother and child cohort study, N = 78 660

Level of severity of sexual violence	Only recently	Only previously	Both previously and recent	Ever
	n (%)	n (%)	n (%)	n (%)
Mild	195 (0.2)	8 837 (11.2)	412 (0.5)	9444 (12.0)
Moderate	15 (0.0)	2200 (2.8)	4 (0.0)	2219 (2.8)
Severe	54 (0.1)	2737 (3.5)	14 (0.0)	2805 (3.6)
Any	264 (0.3)	13 774 (17.5)	430 (0.55)	14 468 (18.4)

Table 2 Characteristics of women without and with a mild, moderate or severe history of sexual violence in the mother and child cohort study, N = 78 660 (column %)

	No sexual violence n = 64 192%	Mild sexual violence n = 9 444%	Moderate sexual violence n = 2 219%	Severe sexual violence n = 2 805%
Age*				
<19	1.1	1.9	2.5	6.1
20–25	16.6	18.7	18.7	26.7
26–31	48.8	43.3	42.3	38.5
32–37	29.2	30.8	30.7	23.7
≥38	4.2	5.3	5.7	4.9
Education*				
Primary	1.9	3.3	5.7	9.7
Secondary	34.4	40.4	45.8	54.3
Higher ≤4 years	40.6	36.4	30.7	24.3
Higher >4 years	23.1	19.9	17.8	11.7
Occupation*				
Employed	82.8	76.3	70.9	62.4
Student	9.5	12.7	14.0	16.2
Not employed	7.7	11.0	15.1	21.4
Civil status*				
Married/cohabitant	97.3	94.2	92.3	88.9
Other	2.7	5.8	7.7	11.1
Smoking during pregnancy*	7.1	11.8	16.5	22.4
Alcohol during pregnancy*	11.3	14.9	14.6	12.5
Parity*				
Nulliparous	55.4	53.1	51.4	55.4
Multiparous	44.6	46.9	48.6	44.6
Pre-pregnancy BMI*				
<20	12.5	12.7	13.3	14.3
20–24.9	56.7	55.9	52.4	48.4
25–29.9	21.6	21.4	22.0	23.3
≥30	9.2	10.0	12.2	13.9
Mental distress*	5.1	12.2	14.5	20.9
Adult physical violence*	9.2	30.7	47.0	53.0
Child physical violence*	2.8	11.0	22.8	34.6
Adult emotional abuse*	12.1	31.4	40.4	44.7
Child emotional abuse*	10.6	23.9	33.0	39.3
Adult sexual abuse Q3*	0.7	20.1	36.1	40.6
Child sexual abuse Q3*	1.8	20.1	40.6	52.8

* P < 0.001 using Pearson χ^2 .

violence ($P > 0.001$). Severe sexual violence was significantly associated with an increased duration of pregnancy-related symptoms (Table 3). An increasing level of severity of sexual violence was associated with an increasing probability of suffering for a longer period of time for the majority of the physical symptoms (Table 3). An increasing level of severity of sexual violence was also associated with an increasing probability of reporting ≥ 8 symptoms (Table 4). Compared to women not reporting

sexual violence, those reporting mild sexual violence were nearly twice as likely to report ≥ 8 symptoms, crude OR 1.95 (1.85–2.06), while women reporting severe sexual violence were three times as likely to report ≥ 8 symptoms, crude OR 3.09 (2.84–3.36) (Table 4). These associations were attenuated, but still significant, when controlling for factors such as age and other types of violence and abuse (Table 4). In a dose–response fashion, the more types of violence and abuse to which women were exposed, the

Table 3 The duration/degree of pregnancy-related symptoms by level of sexual violence, percentages and adjusted † OR, N = 78 660

	No. of 4-week period(s) *	No sexual violence n = 64 192	Mild sexual violence n = 9 444		Moderate sexual violence n = 2 219		Severe sexual violence n = 2 805	
		%	%	AOR (95% CI)	%	AOR (95% CI)	%	AOR (95% CI)
1. Backache	≥5	9.2	13.6	1.29 (1.21–1.38)	15.4	1.32 (1.17–1.49)	18.9	1.48 (1.33–1.65)
2. Tiredness	≥5	13.2	18.1	1.27 (1.20–1.35)	18.8	1.23 (1.10–1.38)	21.8	1.45 (1.31–1.61)
3. Constipation	≥5	9.8	13.5	1.31 (1.22–1.40)	14.7	1.36 (1.20–1.54)	13.0	1.20 (1.06–1.36)
4. Pelvic girdle relaxation	≥4	12.3	16.6	1.23 (1.16–1.31)	18.3	1.25 (1.11–1.40)	21.2	1.40 (1.26–1.55)
5. Heartburn	≥4	11.7	15.2	1.21 (1.14–1.29)	18.1	1.39 (1.24–1.56)	20.1	1.54 (1.39–1.71)
6. Nausea and vomiting	≥3	10.8	12.3	1.26 (1.19–1.34)	14.6	1.27 (1.14–1.43)	17.7	1.66 (1.50–1.83)
7. Edema	≥2	11.6	15.8	1.21 (1.14–1.29)	18.6	1.33 (1.18–1.49)	20.9	1.47 (1.32–1.62)
8. Candidiasis	≥2	12.1	15.1	1.22 (1.14–1.30)	14.9	1.15 (1.02–1.30)	14.1	1.07 (0.95–1.20)
9. Pruritus gravidarum	≥1	13.6	19.0	1.30 (1.23–1.38)	21.1	1.34 (1.20–1.49)	24.1	1.50 (1.36–1.66)
10. Leukorrhea	≥1	7.2	10.7	1.37 (1.27–1.48)	11.6	1.39 (1.21–1.60)	11.1	1.26 (1.11–1.44)
11. Headache	≥2	15.0	20.9	1.27 (1.20–1.34)	23.4	1.33 (1.20–1.48)	26.7	1.48 (1.35–1.62)
12. Urinary Tract Infection	≥1	9.3	11.2	1.09 (1.01–1.17)	13.0	1.18 (1.03–1.35)	13.2	1.11 (0.98–1.25)
13. Urine incontinence	≥1	11.7	17.1	1.33 (1.25–1.41)	17.4	1.22 (1.09–1.37)	19.1	1.35 (1.21–1.50)
14. Leg cramps	≥3	11.1	13.0	1.14 (1.05–1.20)	13.7	1.14 (1.00–1.29)	13.1	1.05 (0.93–1.06)
15. Braxton Hicks contractions	bothered a lot **	12.5	17.0	1.26 (1.19–1.34)	18.3	1.27 (1.14–1.43)	23.0	1.66 (1.50–1.83)

† Adjusted for age, child physical violence, adult physical violence, child emotional abuse and adult emotional abuse. Comparison group is the group of women not reporting sexual violence.* Number of 4-week periods women indicated having suffered from this symptom, maximum possible number of 4-week periods for symptom 1–10 was 8, for symptom 11– 3 it was 6 and for symptom 14 it was 5. ** Question without 4-week periods option.

more likely they were to report ≥8 physical symptoms (not in the tables). The unadjusted OR for women with a history of any sexual violence (including all levels of severity) reporting ≥8 pregnancy-related physical symptoms was 2.24 (2.15–2.35). For women reporting two types, such as both any sexual violence and adult physical violence, the crude OR was 2.70 (2.54–2.87), and for any sexual violence and adult emotional abuse the crude OR was 2.86 (2.68–3.04). For women reporting three types: any sexual violence as well as adult physical violence and adult emotional abuse, the crude OR was 3.18 (2.93–3.44). Having experienced any sexual violence both recently and

previously resulted in a stronger association with ≥8 symptoms, crude OR 3.07 (2.57–3.66), than only previously, crude OR 2.22 (2.12–2.34), and only recently, crude OR 1.73 (1.25–2.40) (not in the tables). A similar pattern was evident for each of the different levels of severity of sexual violence when analyzed separately (Table 5).

Discussion

Eighteen percent of the women in our study reported having experienced any sexual violence. Women with a history of sexual violence suffered from more pregnancy-related physical symptoms, to a greater extent

Table 4 The Odds Ratios (crude and adjusted) for having ≥8 pregnancy-related symptoms, n = 11 532

Type of violence and abuse	≥8 symptoms n	Crude OR Crude OR (95% CI)	Adjusted OR Model 1 AOR (95% CI)	Adjusted OR Model 2 AOR (95% CI)	Adjusted OR Model 3 AOR (95% CI)
Sexual violence					
Mild	2 057	1.95 (1.85–2.06)	1.49 (1.41–1.58)	1.44 (1.37–1.53)	1.44 (1.36–1.53)
Moderate	595	2.57 (2.33–2.83)	1.66 (1.50–1.84)	1.61 (1.46–1.79)	1.60 (1.44–1.78)
Severe	859	3.09 (2.84–3.36)	1.78 (1.62–1.95)	1.68 (1.53–1.84)	1.64 (1.49–1.81)
Adult physical violence	2 806	2.20 (2.10–2.31)	1.35 (1.28–1.43)	1.31 (1.24–1.38)	1.30 (1.22–1.37)
Child physical violence	1 255	2.57 (2.39–2.75)	1.31 (1.21–1.42)	1.27 (1.17–1.38)	1.22 (1.13–1.33)
Adult emotional abuse	3 200	2.28 (2.17–2.38)	1.74 (1.65–1.83)	1.68 (1.60–1.77)	1.48 (1.40–1.56)
Child emotional abuse	2 641	2.12 (2.02–2.23)	1.53 (1.45–1.62)	1.48 (1.40–1.57)	1.70 (1.62–1.80)

Comparison group is the group of women not reporting sexual violence.

Model 1: adjusted for age and other types of abuse.

Model 2: adjusted for age, other types of violence and abuse and mental distress.

Model 3: adjusted for age, other types of violence and abuse, mental distress, BMI, smoking and alcohol consumption and parity.

and for a longer time, compared to women who did not report such a history. Having experienced sexual violence both recently and previously resulted in a stronger association with suffering from ≥ 8 symptoms than sexual violence experienced only previously or only recently.

Our study has several strengths. Firstly, the large sample size gives robust results and allowed considerable adjustment for confounding and mediating factors. In particular, we were able to assess the independent association for sexual violence by controlling for other types of abuse and violence. Secondly, selection bias in relation to the exposure is unlikely as women consenting to participate were not expecting questions on sexual violence. Thirdly, the sample being population-based suggests that our results are generalizable for the Norwegian setting and very likely beyond. However, the low response rate causes concern. We lack information on why women did not participate. Participation involved considerable effort and had no immediate benefits for the women taking part. Nilsen et al. [39] compared participants in the MoBa study to all women giving birth in Norway. They found a strong under-representation of the youngest women (<25 years), those living alone, mothers with more than two previous births and smokers [39]. Despite this, no statistically relative differences in association measure were found between participants and the total population regarding the eight association measures they tested [39]. They therefore concluded that even though the prevalence of both exposure and outcome may be different in the MoBa study compared to the entire pregnant population in Norway, the estimates of association can still be valid [39].

A major limitation of our study is the lack of use of a validated instrument for measuring sexual violence. The Norwegian questionnaire uses the term "seksuell

omgang". The most correct translation for this term in English is "sexual relations", not "intercourse" as written in the English version of the questionnaire translated for the benefit of researchers (not used by participants). The term "sexual relations" is not precise and can include other acts besides intercourse. However, the term points towards physical contact as opposed to non-contact sexual abuse. All three answering options suggest that the sexual relations were unwanted. Our results show an increase in strength of associations from mild to severe sexual violence, which suggests that the study participants also have interpreted these different levels as increasing levels of severity. Our study does not include questions about the timing, frequency or perpetrator of the sexual violence. Information about such factors could shed important light on our findings. For example, we do not know if the prevalence of sexual violence and associations investigated differ significantly for a known compared to unknown perpetrator.

Seventeen percent of the women reporting sexual abuse in Q3 did not report sexual violence in Q1. The majority of these women reported abuse before the age of 18 in Q3. A reasonable explanation for this lack of overlap is that the questions, although similar, are not exactly the same. The questions in Q1 point towards physical-contact sexual violence. The question in Q3 could more easily be interpreted as also including non-contact sexual abuse. For some of those reporting sexual abuse as an adult in Q3 but not in Q1, a possible but unlikely explanation could be that the abuse happened after answering Q1.

Another limitation of our study is the lack of knowledge of the severity of the pregnancy-related physical symptoms, except for the Braxton Hicks contractions.

Table 5 The crude and adjusted OR for having ≥ 8 pregnancy-related symptoms by timing and level of severity of sexual violence

	≥ 8 symptoms n = 11 532	Crude OR (95% CI)	Adjusted OR (95% CI)
Mild sexual violence			
Only previously	1902	1.92 (1.82–2.03)	1.45 (1.37–1.54)*
Only recently	39	1.75 (1.23–2.49)	1.71 (1.20–2.43)**
Both previously and recently	116	2.74 (2.21–3.41)	2.04 (1.63–2.55)*
Moderate sexual violence			
Only previously	591	2.57 (2.33–2.83)	1.58 (1.42–1.76)*
Only recently	2	1.08 (0.24–4.77)	Too few to adjust
Both previously and recently	2	7.00 (0.99–49.72)	Too few to adjust
Severe sexual violence			
Only previously	844	3.12 (2.87–3.40)	1.68 (1.53–1.86)*
Only recently	8	1.22 (0.57–2.58)	1.18 (0.56–2.50)**
Both previously and recently	7	7.00 (2.46–19.97)	6.70 (2.34–19.14)**

Comparison group is the group of women not reporting sexual violence.

* adjusted for age and other types of abuse and violence ** adjusted for age only.

Women were asked if and when they suffered from the pregnancy-related physical symptoms, but not how much. However, even if the women had been asked how badly they suffered from these physical symptoms, the measurement would have remained subjective. Most of the pregnancy-related symptoms are rarely substantiated objectively, as they generally cause no concern regarding the outcome of the pregnancy (e.g. heartburn, constipation, leg cramps, backache), while some symptoms may lead to further investigation to rule out pathology (e.g. edema, pruritis gravidarum, headache, leukorrhea).

Our study, like most others investigating the impact of sexual violence, relies on retrospective self-reporting with the risk of recall bias [40]. Self-reporting begins with the individual perceiving and storing the experience as a memory of sexual violence. Next the study questions have to trigger the participant recall of the event. Studies have shown that the methodology used, i.e. the number of questions asked, the phrasing and the context in which the questions appear, influence the rates of self-reported sexual violence [41,42]. Lastly women have to be willing to disclose their experience [40,41]. Women in our study were sent the questionnaires by post, and if the perpetrator of the unwanted sexual relations was their present partner, fear of retribution resulting from the partner reading their responses may well have stopped disclosure. This could also be one of the reasons why the prevalence of recent sexual violence was so low compared to previously experienced sexual violence. However, our prevalence of recent sexual violence of 0.8% (0.3% only recent and 0.5% both previously and recent) is very similar to that of 1% reported in the first national population based study of violence among Norwegian women [7].

Our lifetime prevalence of ever having experienced sexual violence (18%) is exactly the same as the prevalence reported in the general population (not college students) from a nationwide study in the USA by Kilpatrick et al. [5]. It is difficult to compare our estimates of prevalence of sexual violence with other Norwegian studies due to methodological differences [7,43,44]. A Nordic study on the prevalence of different types of abuse among patients visiting gynecology clinics reported 6.4% prevalence for women ≥ 18 for severe sexual abuse which compares well to our study when we combine the prevalence for moderate and severe sexual violence [10].

A history of sexual violence was associated with the reporting of other types of violence and abuse, particularly during adulthood. The co-occurrence increased with the increasing level of severity of sexual violence (Table 2). This pattern suggests that sexual violence in our study was part of intimate partner violence or domestic violence. This finding agrees with other research

reporting that in the majority of sexual violence cases, the perpetrator is known to the victim. The most common perpetrator of sexual violence occurring in childhood is the father, stepfather or another relative. For adult sexual violence, it is a partner or former partner [5,9]. Co-occurrence of multiple forms of violence and adult re-victimization as suggested in this study are well documented findings [7,16,45,46].

No other studies have investigated the association between a history of any lifetime sexual violence and pregnancy-related physical symptoms. However, other studies have noted the association between sexual violence and a range of somatic health problems in predominantly non-pregnant women [7,15-18,44,45]. Two studies among pregnant women showed a significant association between childhood sexual abuse and physical symptoms and complaints [22,23]. A Swedish study of a general population of pregnant women with the primary purpose to determine the prevalence of lifetime sexual abuse, reported that such a history was associated with increased reporting of general health problems [9]. They focused on diagnoses and diseases with little attention to symptoms reported by women.

The MoBa study is a large epidemiological study designed to investigate many correlations [24] but not causality. Our study therefore examined the association between different levels of sexual violence and pregnancy-related physical symptoms. We did, however, estimate the effect on the associations for some of the intermediate factors which according to the literature [47-49] are considered to be on the pathway between exposure and outcome by adjusting for them in logistic regression models. Different pathways have been proposed to explain the association between sexual violence and pregnancy-related physical symptoms [47,48]. Some symptoms could be linked to behavioral risk factors, such as obesity and smoking, which are more prevalent among victims of sexual violence and abuse, both in our study and others [48]. In our study, adjusting for these factors did not alter the association considerably. The psychological pathway seems of importance. As with the reporting of most physical complaints, psychological factors may increase the reporting of pregnancy-related physical symptoms [48,50]. This pathway includes conditions such as hyper-vigilance, somatization, anxiety, sleeping difficulties and hostility, and is put forward by several researchers in relation to the experience of physical symptoms and poor self-reported health [15,47-49,51,52]. In addition, some studies suggest that current life stressors increase the rate of health problems more for abused individuals than for those without a history of abuse [53,54]. Pregnancy and the anticipation of childbirth itself have been recognized as possible stressors for most pregnant women, while severe fear of

childbirth has been associated with a history of sexual abuse [55-57]. In our study we noticed that the associations changed noticeably when mental distress was entered in the model. Our study, which is based on data from a cohort study, has a cross-sectional design and can therefore not show a causal link between the experience of sexual violence and pregnancy-related physical symptoms. However, in most cases the sexual violence occurred before the pregnancy. This fact and the increased strength of the association with increased severity offer support to a causal association [29].

Conclusions

We found that women who reported sexual violence suffered longer and from more pregnancy-related physical symptoms compared to women not reporting sexual violence. The symptoms may seem like minor complaints to those who provide health care during pregnancy. However, they may cause women major discomfort and severely affect their well-being during pregnancy. Few women spontaneously disclose their history of violence to health professionals [10,28]. Clinicians should consider the possible role of a history of sexual violence or other abuse when treating women who suffer to a great extent from pregnancy-related physical symptoms.

Abbreviations

Q1, Questionnaire 1; Q3, Questionnaire 3; AOR, Adjusted Odds Ratio; OR, Odds Ratio; CI, Confidence Interval; NorAq, Norvold Abuse questionnaire; BMI, Body Mass Index; SCL-5, Symptom Check List with 5 items; MoBa, Norwegian Mother and Child Cohort Study; MBRN, Medical Birth Registry of Norway.

Competing interests

There are no competing interests.

Authors' contributions

ML conceived the study, performed the analyses, drafted and corrected the manuscript. LH participated in the statistical analyses and drafting of the manuscript. SV participated in the conception of the study, advised on the statistical analyses and participated in the drafting of the manuscript. BS participated in the conception and design of the study, advised on the statistical analyses and drafted the manuscript. All authors read and approved the final manuscript.

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BMJ Open Sexual violence and neonatal outcomes: a Norwegian population-based cohort study

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ABSTRACT

Objective: The objective of this study was to explore the association between sexual violence and neonatal outcomes.

Design: National cohort study.

Setting: Women were recruited to the Norwegian Mother and Child Cohort Study (MoBa) while attending routine ultrasound examinations from 1999 to 2008.

Population: A total of 76 870 pregnant women.

Methods: Sexual violence and maternal characteristics were self-reported in postal questionnaires during pregnancy. Neonatal outcomes were retrieved from the Medical Birth Registry of Norway (MBRN). Risk estimations were performed with linear and logistic regression analysis. Outcome measures: gestational age at birth, birth weight, preterm birth (PTB), low birth weight (LBW) and small for gestational age (SGA).

Results: Of 76 870 women, 18.4% reported a history of sexual violence. A total of 4.7% delivered prematurely, 2.7% had children with a birth weight <2500 g and 8.1% children were small for their gestational age. Women reporting moderate or severe sexual violence (rape) had a significantly reduced gestational length (2 days) when the birth was provider-initiated in an analysis adjusted for age, parity, education, smoking, body mass index and mental distress. Those exposed to severe sexual violence had a significantly reduced gestational length of 0.51 days with a spontaneous start of birth. Crude estimates showed that severe sexual violence was associated with PTB, LBW and SGA. When controlling for the aforementioned sociodemographic and behavioural factors, the association was no longer significant.

Conclusions: Sexual violence was not associated with adverse neonatal outcomes. Moderate and severe violence had a small but significant effect on gestational age; however, the clinical influence of this finding is most likely limited. Women exposed to sexual violence in this study reported more of the sociodemographic and behavioural factors associated with PTB, LBW and SGA compared with non-abused women.

INTRODUCTION

Preterm birth (PTB) is a common and costly health problem.^{1 2} Approximately 1 in 10

Strengths and limitations of this study

- This study was based on information from a large population-based study described as sufficient for large-scale epidemiological studies.
- All outcomes were collected prospectively from a quality-assessed birth register.
- The setting, with small social and health inequalities, was suitable to isolate the effect of sexual violence on adverse neonatal outcomes.
- A non-validated instrument for measuring of the exposure variable was a limitation to this study.

babies are born preterm worldwide, and prematurity is considered to be the leading cause of death for newborns.² Low birth weight (LBW) can be a consequence of PTB or intrauterine growth restriction, the latter leading to the birth of small for gestational age (SGA) infants.³ Research has suggested some biological risk factors for PTB and LBW: multiple pregnancies, a previous PTB and uterine or placental abnormalities.^{1 3} Studies also emphasise other, less understood factors for PTB and LBW.¹ These are maternal age, socioeconomic status, ethnicity, maternal weight, substance abuse, stress, depression and violence.^{1 2 4}

Violence against women is a significant public health problem, and a recent report from the WHO states that 35% of women worldwide have experienced either physical and/or sexual intimate partner violence or non-partner sexual violence.⁵ A pregnancy does not protect women from violence, and the prevalence of physical or sexual violence during pregnancy ranges from 3.4% to 11% in high-income countries.⁶ It is recognised that violence has an adverse impact on women's physical, sexual, reproductive and mental health.^{5 7}

A connection between PTB or LBW and violence against women has been reported, but the association is supported as well as contradicted.^{5 8–20} Several pathways between



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sexual violence and adverse pregnancy outcomes are suggested.⁵ A direct pathway of sexual violence can result in immediate complications such as bleeding and rupture of membranes, which can lead to a PTB.^{5 16} Other, more indirect pathways are suggested mediated by stress and stress responses¹⁸ or by behavioural factors such as smoking or substance abuse, used to cope with the negative consequences of violence.⁵

Studies have primarily addressed physical abuse during pregnancy and PTB or LBW^{8 10 11 16–19 21} or child sexual abuse and PTB/LBW.^{9 12} Results from a new meta-analysis published in the recent WHO report⁵ have demonstrated an association between intimate partner violence, including physical and sexual abuse, and PTB with an adjusted OR (AOR) of 1.41 (95% CI 1.21 to 1.62) and AOR of 1.16 (95% CI 1.02 to 1.29) with LBW.⁵ However, studies that have investigated the impact of sexual violence on neonatal outcomes specifically are limited and few population-based studies with large sample sizes that enable controlling for confounding variables have been conducted.^{5 11} The Norwegian Mother and Child Cohort Study (MoBa) is a population-based prospective cohort study of pregnant women, which includes measurements of lifetime sexual violence, sexual violence during pregnancy and other relevant covariates, which makes it suitable to examine associations between sexual violence and neonatal outcome. In this study, we assessed the relationship between sexual violence and gestational age at birth and birth weight. Additionally, we explored the associations between sexual violence and PTB, LBW and SGA.

METHODS

This study was a subproject in the MoBa study that was conducted by the Norwegian Institute of Public health from 1999 to 2008.²² All pregnant women in Norway were eligible to participate in MoBa, and they were recruited during their routine fetal ultrasound examination. Of the invited women, 40.6% consented to participate. Data were obtained through extensive self-administered questionnaires that contained demographic factors, general health, reproductive history and questions about maternal health status during pregnancy. Our analyses were based on questionnaire 1 (Q1), which was completed during (approximately) gestational week 17, and Q3, which was completed during (approximately) gestational week 30. Data from MoBa were linked with data from the Medical Birth Registry of Norway (MBRN), which provided information on pregnancy and birth outcome. The current study is based on version VI of the quality-assured data files released for research in 2011. The MoBa study is described in detail elsewhere.²² The questionnaires that were used in MoBa are available at the internet-site: <http://www.fhi.no/studier/den-norske-mor-og-barn-undersokelsen/sporreskjemaer>

Study population

This study included women who had a singleton birth between 22 and 44 weeks of gestation, who completed Q1 and Q3, had MBRN data available and participated for the first time (79 363 women). While a pregnancy is the observation unit in the MoBa study, women are the observation unit in our study; hence, the exclusion of 13 475 pregnancies of women who participated more than once. We excluded 703 women who did not answer the questions on sexual violence. Further, we excluded records with missing data on gestational length (n=297) and birth weight (n=41). We also excluded six children with birth weight <500 g and four children with birth weight >6000 g, leaving a study sample of 76 870 women (figure 1).

Variables

Exposure variable

The exposure variable was collected from Q1. Women were asked if they had been pressured or forced into sexual relations. There were four possible answer options: (1) No, never; (2) Yes, pressured; (3) Yes, forced with violence; or (4) Yes, raped. A positive answer was defined as having experienced sexual violence. Women with more than one positive answer were classified according to the most severe level reported. The answering options were coded into three levels of severity for the sexual violence: (1) mild (pressured); (2) moderate (forced with violence) and (3) severe (raped). Women could also indicate when the violence had taken place: (1) during this pregnancy; (2) during the last 6 months before pregnancy; or (3) earlier. Approximately 1700 women who filled out the first version of Q1 had the answering options earlier and during the last 12 months when assessing time. We therefore created the variables previous and recent sexual violence, with 'recent' containing sexual violence during the last 12 months, including the current pregnancy. Among the women who participated several times we included the first pregnancy only to ensure that the exposure was included only once per woman. More details about the exposure variable can be found in our previous studies^{23 24} and in online supplementary table S1.

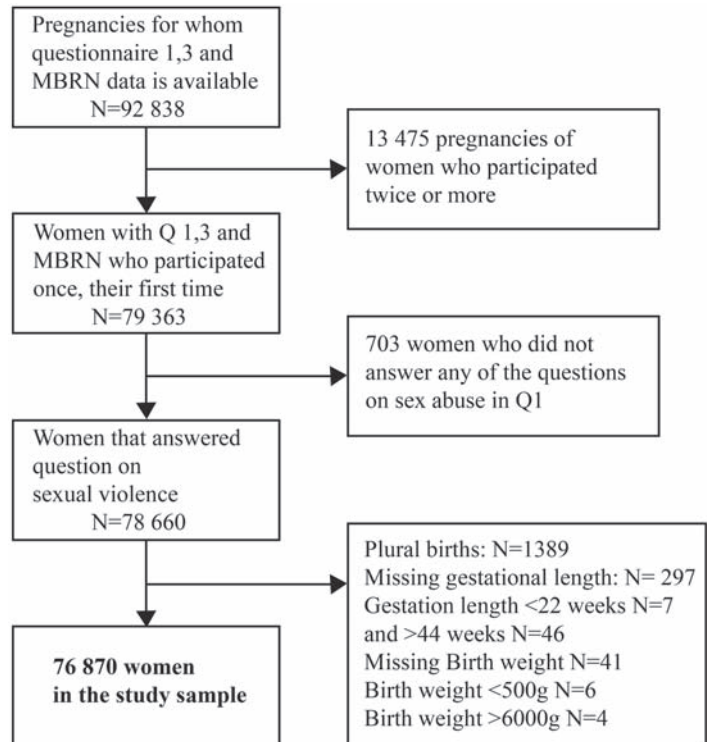
Outcome variables

All outcome variables were obtained from the MBRN. Gestational age at birth in days was based on ultrasound at (approximately) gestational week 18. For women with no ultrasound, the gestational age was based on the last menstrual period (1.7%). PTB was defined as a gestational age <37, LBW as a birth weight <2500 g, and SGA was defined as birth weight below the 10th centile for the gestational age at birth. SGA was calculated using Norwegian specific fetal growth tables by Skjaerven *et al.*²⁵

Adjusting variables

Maternal age, parity, socioeconomic status, smoking and body mass index (BMI) were considered as possible

Figure 1 Inclusion and exclusion process.



confounding factors and were adjusted for. All adjusting variables were taken from the MoBa. In Q1, age was categorised into five groups: younger than 20 years, 20–24 years, 25–29 years, 30–34 years or 35 years and older. As a proxy for socioeconomic status, we used the woman's education in years (categorised into 4 groups): primary (<12 years), secondary (12 years), higher education ≤4 years (13–16 years) and higher education >4 years (≥17 years). Parity was dichotomised into nulliparous and multiparous women. Smoking was categorised as no smoking or smoking, which included daily and occasional smoking. BMI was grouped into four categories: <20, 20–24.9, 25.0–29.9 or ≥30.0 kg/m². We also adjusted for mental distress because it is considered to be associated with the exposure as well as the outcome.^{4 5} Mental distress was measured using five items from the Hopkins symptoms checklist (SCL-5) with a cut-off at ≥2.0 points, as suggested by Strand *et al*²⁶ and obtained from Q3.

Owing to the co-occurrence of different violence types,⁷ we examined the effect of physical and emotional abuse as a child or as an adult in the multivariable statistical models. Information on adult physical violence was taken from Q1 and consisted of a positive answer to whether women as adults had experienced being slapped, hit, kicked or otherwise physically abused.

Child physical violence was taken from Q3 and consisted of a positive answer to the question “Have you experienced physical violence before the age of 18?” Emotional abuse as a child (<18) or as an adult (≥18) consisted of a positive answer to either, “Someone has over a long period of time systematically tried to subdue, degrade or humiliate you” or “Someone has threatened to hurt you or someone close to you”, or both.

Previous PTB and inadequate antenatal care are considered to be associated with the exposure and the outcomes.^{2 3 5} As a previous PTB may be a result of sexual violence prior to the related pregnancy, we did not control for a previous PTB. In Norway, the majority of women attend antenatal care, a free and well-integrated part of the public health system; therefore, we did not control for antenatal care. Ethnicity was not considered a relevant covariate in our study because the majority of the MoBa participants are ethnic Norwegian.

Statistical analysis

Characteristics were presented as percentages within the entire sample and the different outcomes. Linear regression was performed to assess differences in birth weight and gestational age for children born to women with and without a history of mild, moderate and severe sexual violence. The association between sexual violence

and PTB, LBW and SGA was estimated with crude and AORs using logistic regression analysis. Sexual violence was analysed as a categorical variable: 1=mild sexual violence, 2=moderate sexual violence and 3=severe sexual violence with no sexual violence as the reference group. All analyses were adjusted for maternal age, parity, education, smoking, BMI and mental distress in the first step. Birth weight was additionally adjusted for gestational age. We further adjusted for other types of violence in the second step. We initially tested the correlation between other types of violence and sexual violence because of co-occurrence, and all Pearson's correlation coefficients were below the generally accepted cut-off of <0.4 for use as a covariate in the regression analyses.²⁷ Post protocol, we stratified the sample into spontaneous start of birth and provider-initiated start of birth (induced start of birth or elective caesarean section) for gestational age because a provider-initiated start could influence the time point of birth. Information on how the birth started was taken from MBRN. We additionally performed a sensitivity analysis in which we examined the association between sexual violence and SGA and LBW among women who had a spontaneous birth at term (≥ 37 weeks) because we wanted to examine the effect of violence in a group of women who were considered to be low risk according to gestational age and start of birth. When we examined the timing of the sexual violence, we compared women who were exposed to recent sexual violence (within the last 12 months) and those exposed to previous sexual violence to non-abused women. We also examined the timing among women reporting recent and previous severe sexual violence (rape) for all outcomes. The prevalence of missing data was generally low with 2.5% for BMI, 3.7% for education and 0.7% for smoking during pregnancy. Owing to this, no imputing methods for missing data were used,²⁸ except for the missing data for the SCL-5 (3.2%), which were replaced by the series mean. The results of the logistic regression analyses remained approximately the same when performed with the complete exclusion of missing data compared with using the imputed missing data for SCL-5.

The comparison group for all analyses was women not reporting any sexual violence. All analyses were performed with the statistical package SPSS for WINDOWS (SPSS Inc, Chicago, Illinois, USA) V.18. *p* values <0.05 were considered statistically significant.

RESULTS

The mean gestational age at birth in the total sample was 279.6 days (SD 11.9 days), and the mean birth weight was 3592.7 g (SD 547.1 g). Table 1 displays the characteristics in the total sample and by the different outcomes.

The prevalence of adverse neonatal outcomes was generally highest in the youngest (<20 years) and the oldest

age groups (≥ 35 years) among smokers and women with primary school education. A BMI ≥ 30 was associated with PTB and LBW and BMI <20 with SGA. Women who reported mental distress also reported more PTB, LBW and SGA.

Among the 76 870 women enrolled, 9263 (12.1%) reported a history of mild sexual violence, 2102 (2.8%) moderate and 2746 (3.5%) severe. Women with a history of sexual violence were significantly younger and were more likely to have had primary school education. Additionally, these women more frequently reported smoking, a BMI ≥ 30 and mental distress. These women more often experienced other types of violence as children and also as adults (data not provided in tables).

A lower gestational age at birth was observed for newborns from women who reported moderate and severe sexual violence of approximately 2 days when birth was provider-initiated (table 2).

Among women with a spontaneous start of birth, the gestational age was approximately one half of a day shorter when women reported severe sexual violence. These findings were significant in an adjusted analysis. A crude analysis showed that women who reported a history of severe violence delivered on average 38.3 g lighter children, a difference that disappeared when controlling for gestational age, mother's age, parity, education, smoking, BMI and mental distress. There were no differences regarding birth weight between women with a history of mild or moderate sexual violence compared with non-abused women.

Results from the logistic regression analysis are presented in table 3.

Women who reported severe sexual violence had higher odds of PTB, LBW and SGA in a crude analysis, an association that was attenuated and no longer significant when adjusted for maternal age, parity, education, smoking, BMI and mental distress. Other types of violence, as a child and as an adult, had small attenuating effects on the ORs and were not included in the final models.

The sensitivity analysis, in which we examined the association between a history of sexual violence and SGA and LBW in a subsample of women who had a spontaneous term birth, showed the same pattern as in the total sample reported in table 3. Women who reported severe sexual violence had higher odds of LBW and SGA in a crude analysis but not in the adjusted analysis (data not provided in tables).

A crude analysis was used to examine if the timing of the violence was associated with adverse outcome. Women who reported recent sexual violence had a higher risk for LBW (OR 1.60 95% CI 1.04 to 2.17) compared with non-abused women. The association was no longer significant in the adjusted analysis. In our study, 684 (0.9%) women reported recent sexual violence (mild, moderate and severe) and 13 487 (17.5%) previous sexual violence (see online supplementary table S2).

Table 1 Background characteristics in the total sample and by PTB: gestational age <week 37, LBW: weight <2500 g and SGA weight below the 10th percentile by gestational age at birth in the Mother and Child Cohort

	Total N=76 870 %	PTB N=3620 %	LBW N=2107 %	SGA N=6257 %
Age				
<20	1.5	2.2	2.6	1.9
20–24	12.2	12.7	13.8	13.2
25–29	36.2	34.6	34.8	36.4
30–34	35.7	33.7	33.2	34.2
≥35	14.4	16.7	15.6	14.3
Education				
Primary	2.4	3.1	3.9	2.7
Secondary	34.8	38.5	38.8	35.0
Higher ≤4 years	37.8	35.6	37.3	36.1
Higher >4 years	21.3	19.2	20.5	22.2
Missing	3.7	3.6	3.7	3.9
Parity				
Nulliparous	54.9	61.7	68.2	70.7
Multiparous	45.1	38.3	31.8	29.3
Smoking				
No	90.9	89.3	85.8	85.6
Yes	8.5	10.1	13.6	13.6
Missing	0.7	0.6	0.6	0.7
Prepregnancy body mass index				
<20	12.4	12.8	15.6	19.1
20–24.9	54.9	49.9	50.8	55.6
25–29.9	21.0	22.0	19.0	15.2
≥30	9.2	12.6	11.8	7.6
Missing	2.5	2.7	2.9	2.4
Mental distress				
No	93.3	92.3	91.3	92.3
Yes	6.8	7.7	8.7	7.7
Adult physical violence				
No	85.5	83.9	83.6	84.7
Yes	14.5	16.1	16.4	15.3
Child physical violence				
No	94.5	94.4	94.1	94.3
Yes	5.5	5.6	5.9	5.5
Adult emotional abuse				
No	83.6	82.1	81.3	82.5
Yes	16.4	17.9	18.7	17.5
Child emotional abuse				
No	86.2	85.1	84.7	85.5
Yes	13.8	14.9	15.3	14.5

LBW, low birth weight; PTB, preterm birth; SGA, small for gestational age.

There was no association between recent severe sexual violence (rape) and adverse neonatal outcome (see online supplementary Table S3). There were 66 (0.1%) women who reported recent rape in this study.

DISCUSSION

Main outcome

We found that moderate and severe sexual violence were associated with a reduction in gestational age at birth. The largest effect was observed when birth was provider-initiated among women exposed to moderate or severe

violence. These women had an approximately two-day reduction in gestational age. There was no significant association between sexual violence and PTB, LBW or SGA in the adjusted analysis.

Strength

This study, based on information from a large population-based study, the MoBa, which is linked to the MBRN, gave a unique opportunity to assess the association between sexual violence and outcome for newborns. The validity of the data in MoBa has in earlier research been described as sufficient for large-scale

Table 2 Differences in gestational age for spontaneous and provider-initiated start of birth and birth weight for non-exposed women and women exposed to mild, moderate or severe sexual violence

	N=76 870 (%)	Mean	Crude estimate β (95% CI)	Adjusted estimate β (95% CI)*
<i>Gestational age</i>				
No sexual violence	62 699 (81.6)	279.7 days	1	1
Mild sexual violence	9263 (12.1)			
Spontaneous start	7323 (11.5)	279.9 days	0.09 (−0.16 to 0.33)	0.22 (−0.04 to −0.48)
Provider-initiated start	1940 (12.5)	280.3 days	0.36 (−0.37 to 1.08)	0.64 (−0.11 to 1.39)
Moderate sexual violence	2162 (2.8)			
Spontaneous start	1670 (2.7)	279.3 days	−0.40 (−0.87 to 0.06)	−0.28 (−0.78 to 0.21)
Provider-initiated start	492 (3.2)	277.6 days	−2.13 (−3.41 to −0.84)	−2.02 (−3.39 to −0.67)
Severe sexual violence	2746 (3.6)			
Spontaneous start	2048 (3.3)	278.7 days	−0.91 (−1.37 to −0.44)	−0.65 (−1.15 to −0.16)
Provider-initiated start	698 (4.5)	277.5 days	−2.24 (−3.47 to −1.01)	−1.92 (−3.22 to −0.62)
<i>Birth weight</i>				
No sexual violence	62 699 (81.6)	3594 g	1	1
Mild sexual violence	9263 (12.1)	3597 g	2.03 (−9.26 to 13.32)	0.04 (−9.16 to 9.23)†
Moderate sexual violence	2162 (2.8)	3582 g	−13.61 (−34.74 to 7.51)	6.11 (−11.30 to 23.52)†
Severe sexual violence	2746 (3.6)	3556 g	−38.33 (−59.17 to −17.49)	−0.76 (−18.05 to 16.53)†

*Adjusted for maternal age, parity, education, smoking, body mass index and mental distress.

†Additional adjustment for gestational age.

epidemiological studies.^{29 30} Our study was strengthened by the fact that the information on the different outcome variables was collected prospectively from the quality-assessed MBRN.³¹ The outcomes in this study are part of a complex phenomenon that has several different risk factors.² The setting in this study, with small social and health inequalities, may therefore be suitable to isolate the effect of sexual violence on adverse neonatal outcomes.

Limitations

There are also limitations to our study. The participation rate of 40.6% in MoBa is low, and MoBa suffers to some

extent from selection bias. The women included in the study are older, have more education, smoke less and are less likely to be of a non-Norwegian origin than the Norwegian population. Although it is likely that there is a socioeconomic gradient that influences prevalence estimates, a recent study by Nilsen *et al*³² found no evidence that the exposure-outcome associations in the MoBa study were affected by selection bias. This socioeconomic gradient may also limit the generalisability of our findings. The lack of a validated instrument for measuring the exposure is a limitation to this study, and violence measured in modules as part of a larger questionnaire, as that in MoBa, may achieve a lower

Table 3 Odds of PTB, LBW and SGA with 95% CIs according to the different levels of sexual violence

	N (%)	Prevalence (%)	Crude OR (95% CI)	Adjusted OR (95% CI)*
PTB				
No sexual violence	62 699 (81.6)	2931 (4.7)	1	1
Mild sexual violence	9263 (12.1)	412 (4.4)	0.95 (0.85 to 1.06)	0.93 (0.83 to 1.03)
Moderate sexual violence	2162 (2.8)	115 (5.3)	1.15 (0.95 to 1.39)	1.14 (0.93 to 1.39)
Severe sexual violence	2746 (3.6)	162 (5.9)	1.28 (1.08 to 1.51)	1.15 (0.97 to 1.37)
LBW				
No sexual violence	62 699 (81.6)	2107 (2.7)	1	1
Mild sexual violence	9263 (12.1)	1681 (2.7)	1.04 (0.91 to 1.18)	0.98 (0.85 to 1.12)
Moderate sexual violence	2162 (2.8)	257 (2.8)	1.30 (1.03 to 1.65)	1.19 (0.93 to 1.53)
Severe sexual violence	2746 (3.6)	75 (3.5)	1.29 (1.04 to 1.59)	1.07 (0.85 to 1.34)
SGA				
No sexual violence	62 699 (81.6)	6257 (8.1)	1	1
Mild sexual violence	9263 (12.1)	5061 (8.1)	1.03 (0.95 to 1.12)	1.00 (0.91 to 1.08)
Moderate sexual violence	2162 (2.8)	768 (8.3)	1.02 (0.87 to 1.19)	0.95 (0.80 to 1.12)
Severe sexual violence	2746 (3.6)	178 (8.3)	1.14 (1.00 to 1.30)	1.05 (0.91 to 1.21)

*Adjusted for maternal age, parity, education, smoking, body mass index and mental distress.

LBW, low birth weight; PTB, preterm birth; SGA, small for gestational age.

disclosure rate.⁵ However, a similar prevalence to that found in our study was reported in a Nordic study examining sexual violence and health.³³ The exposure was measured in gestational week 17, and sexual violence during pregnancy after this is therefore not included. In addition, we have no information on the context and frequency of the violence or information regarding the perpetrator.

To our knowledge, no studies have examined the influence of lifetime sexual violence reported during pregnancy on the gestational age at birth for newborns. There were minor differences in the gestational age between abused and non-abused women in this study, and the clinical importance of our findings for the health of the newborn is most likely limited. However, the difference between the provider-initiated and spontaneous initiation of birth may be of interest. Shorter provider-initiated pregnancies may suggest an increase in elective inductions and elective caesarean sections for those exposed to violence. This is supported by others^{34 35} and in our previous study on sexual violence and maternal outcome.³⁶ Studies have emphasised the meaning of control for abused women when giving birth,³⁷ and choosing a planned start of birth may help the abused women remain in control.

Unlike the current meta-analysis (not yet published) mentioned in a WHO report,⁵ we did not find sexual violence to be associated with PTB and LBW in adjusted analysis. To our knowledge, no study has found an association between violence and SGA. The studies included in the meta-analysis were limited to sexual and/or physical intimate partner violence. However, our findings are supported by a Canadian population-based study with a sample of 6421 pregnant women¹⁷ and a prospective cohort study including 1555 women from the US.¹⁵ The exposure in these studies was physical and sexual violence prior to pregnancy and in pregnancy without being limited to an intimate partner.^{15 17} These studies showed no association between violence and PTB or LBW.

The nature of the exposure measured in the MoBa study makes it difficult to directly compare our findings to others, mainly because we examined lifetime sexual violence by any perpetrator, not limited to intimate partner. Sexual violence is considered to be traumatic for the victim regardless of whether the perpetrator is a partner or not.³⁸ When an intimate partner is the perpetrator, sexual violence may in addition be accompanied by controlling behaviour and include physical and emotional abuse.³⁸ Rape by strangers is usually a single violent event with a higher risk of physical injury. Both forms of violence are associated with adverse health effects,^{5 38} but the effect may differ. Unfortunately, we were not able to examine the effect of the perpetrator in this study because the MoBa study does not provide this information. However, research suggests that a substantial proportion of sexual violence occurs within an intimate relationship.³⁸ It is not unlikely that the

question about severe sexual violence (rape) primarily reflects non-partner sexual abuse and that mild sexual violence (pressured to sexual acts) may be a more psychological exposure. Our crude analyses showed different results, with a significantly higher OR for adverse neonatal outcome among women who reported severe sexual violence, thus supporting the idea that the different levels of violence are different exposures. The use of a more comprehensive instrument when measuring the exposure, with multiple response options regarding context, frequency and perpetrator would have clarified this further and provided more comprehensive knowledge about the nature of the violence. Nevertheless, we had the opportunity to control for emotional and physical abuse in preliminary analysis and this did not change the ORs.

The prevalence of abuse during pregnancy is small in our study and may have decreased the power to detect an association between violence during pregnancy and adverse neonatal outcomes, an association that is supported by other studies.^{10 14 39 40} Living in an abusive relationship may have stopped women from disclosing the violence. In our study, sexual violence was assessed approximately in gestational week 17, and events of violence after that have been missed. Some studies suggest that the risk of sexual violence may increase with the length of the pregnancy for women who are exposed.⁴¹ The studies that report the highest prevalence of violence have measured this several times during pregnancy.⁶ Studies have reported a violence prevalence during pregnancy of between 3% and 19%,^{6 42} including physical and sexual violence. Under-reporting among the non-exposed may have caused a misclassification that has diminished the associations between sexual violence and neonatal outcomes in our study. Since the exposure was collected before the outcome, it is unlikely that misclassification was related to the outcome, thus resulting in a non-differential misclassification that has biased the result towards the null. However, our prevalence of recent sexual (0.9%) violence is similar to the prevalence of 1% reported in a survey that assessed intimate partner violence among a representative sample of Norwegian women.⁴³ This number reflects the prevalence of sexual violence reported during the last year.

Several pathways between sexual violence and adverse neonatal outcomes are suggested, direct as well as indirect.⁵ The direct pathway of violence during pregnancy can cause immediate complications such as bleeding, rupture of membranes and PTB, and examples of indirect pathways include more health-risk behaviours, depression and stress/anxiety.^{5 44} Experienced violence and living in an abusive environment can both cause increased stress levels, which could be on the pathway between abuse and adverse neonatal outcome. Maternal exposure to stress can influence the hypothalamic pituitary adrenal axis hormones, and it is suggested that changes in these hormones may cause negative outcomes, such as a reduction in gestational age and fetal

growth restriction.^{4 45} It has been proposed that mental distress and symptoms of depression are on the causal pathway between violence and adverse health outcome, yet it has also been suggested that women with mental health difficulties are more likely to be victims of violence.⁴⁶ As the relationship may be bidirectional, we chose to control for mental distress in our study. Similarly, the health-risk behaviours, smoking and BMI may be on the pathway between sexual violence and neonatal outcome. Nevertheless, we kept these covariates in the regression analysis because they are especially related to birth weight and PTB.^{3 47}

CONCLUSION

Overall, our findings provide no evidence for an association between lifetime sexual violence and adverse neonatal outcomes. A small significant effect on the gestational age at birth was detected, but the clinical importance of this is most likely limited for the health of the newborn. PTB, LBW and SGA all have complex origins with multiple possible pathways.^{1 2} Although we did not find an association between sexual violence and PTB, LBW or SGA in adjusted analyses, crude analyses in our study suggested that sexual violence may be a risk factor for adverse neonatal outcomes for some women; however, for the majority of women, the relationship was confounded by other risk factors. It is possible that these factors were the result of prior exposure to violence, but this could not be assessed in this study. Antenatal care is one of the most important entry points in which women seek healthcare without necessarily disclosing ongoing exposure to violence or a history of sexual violence. It is recommended that caregivers and clinicians ask women about exposure to violence when assessing conditions that may be complicated by violence.⁴⁸ More knowledge about this condition is needed. Additionally, antenatal care may offer opportunities for women to receive help if they are exposed to violence and also in providing assistance to change behavioural factors contributing to adverse outcomes.

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